SEPTEMBER, 1955

WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING, PRODUCING OPERATIONS AND MANAGEMENT

CURRENT OUTLOOK: Colorado faces the future with optimism.

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PRODUCTION: A symposium on permanent-type completions.

UNIVERSITY OF MICHIGAN

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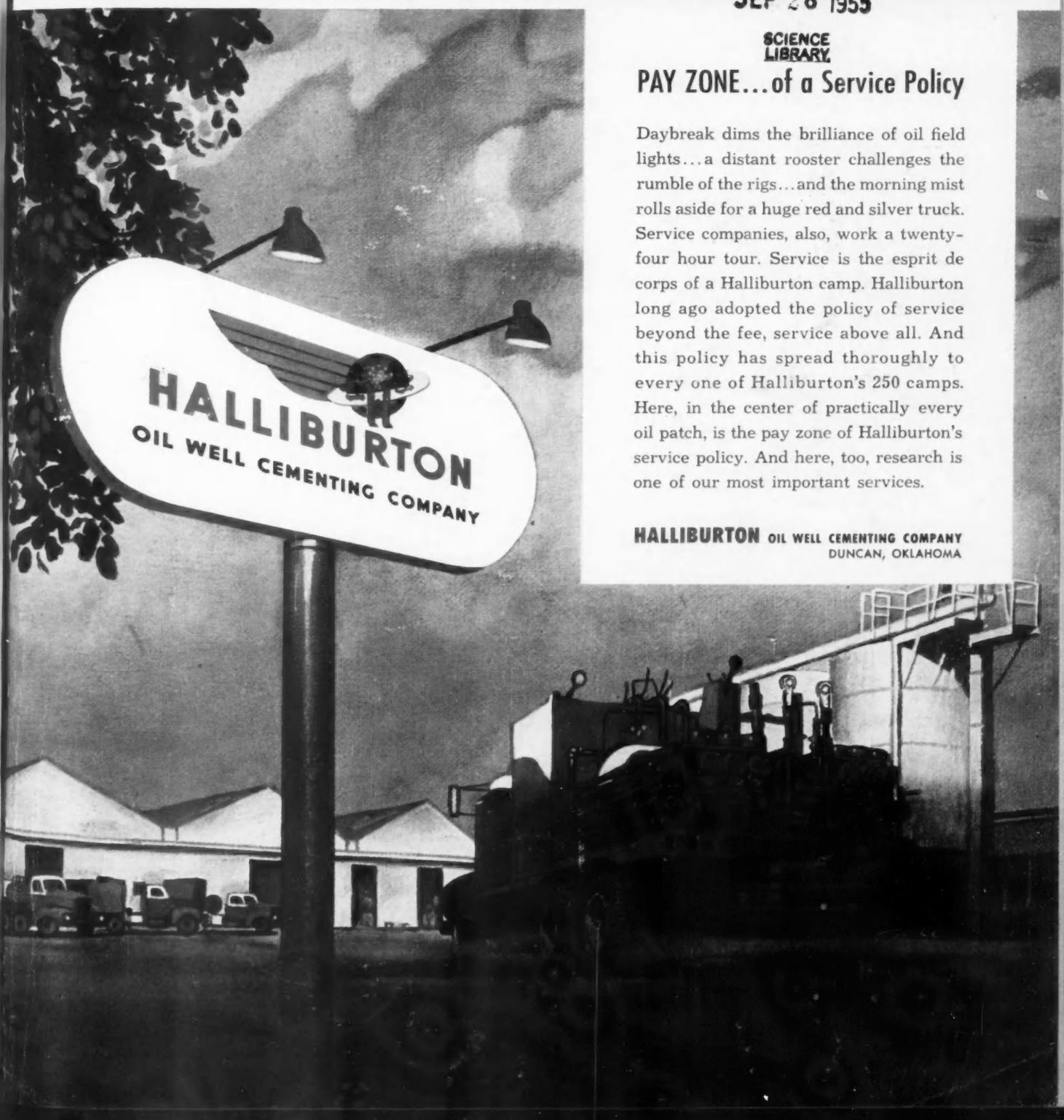

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Vol. 141, No. 4

September, 1955

WORLD OIL

Established 1916 as The OIL WEEKLY

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a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK

☐ **Important expansion** of the oil industry in Colorado is looked for in the coming decade. The state already has oil and gas production in nearly every district. The numerous basins doubtless will provide additional fields. Crude reserves now total 328 million barrels. They are expected to amount to 500 million within 10 years. Crude production at present exceeds 140,000 barrels per day. It should go over 150,000 bpd in the future. Both wildcatting and field development

Turn the Page ➧

A symposium on permanent-type well

☐ **Rapid progress has been made** in working over of permanent-type well completions. Many new tools and techniques have been introduced. With the solution of the problems confronting this type of operation, it becomes apparent that the use of small through-the-tubing tools will permit a cost reduction and still allow better well control. For an up-to-date discussion of the advancements in through-the-tubing workover operations, see the article beginning on **Page 135. New Developments Improve Workover of Permanent-Type Well Completions. T. A. Huber and G. H. Tausch**

☐ **A newly-designed** workover truck for permanent-type well completions does all the wire line, cementing, and gun perforating operations normally performed by three different service units. This unusual vehicle has demonstrated its ability to do better work at much more economical costs than standard equipment. Despite the amount of equipment carried, the unit is within highway weight limitations. **Three-in-One Workover Truck Does a Better Job at Less Expense.** ..... **Page 144**

☐ **Small diameter logging instruments** for use in permanent-type or through-tubing completions have been improved to the point that they can provide logs comparable in quality to those made with larger detectors. Both gamma ray and neutron have been run successfully and their performances indicate a wide range of ap-

CURRENT OUTLOOK . . . *continued*

are proceeding actively and possibilities for discovery and development are excellent in many areas. See **Page 44. Colorado—A Bright Oil Future**.....**L. D. Sloan**

☐ **How do you make a capital outlay decision?** Do you consider all aspects of capital outlays? Do your present methods of evaluation meet current requirements? The article starting on **Page 50** is an analysis of one company's policies and methods in developing good capital outlay programs and methods of evaluations. **Evaluating Investments by the Discounted Cash Flow Method**.....**G. V. Rohleder**

☐ **Oil industry earnings** in the first half of 1955 were about 11 percent higher than in the first half of 1954 and a similar increase may be recorded for the entire year. Outlook is clouded somewhat by the increases in cost of materials and wages without compensating hikes in prices of petroleum products. But demand is up. Higher costs may be covered by increased volumes of business. For results by companies, see **Page 54. Oil Company Earnings Up 11 Percent**. .**L. J. Logan**

☐ **Mister, can you spare a few million?** Preposterous? Not at all. The multitude of charitable demands upon the oil industry's bank accounts and the time of its executives add up to a tremendous sum at the best. How much should you give and to whom? See **Page 61** for some money-saving answers. **System Needed for Wise Company Giving**.....**Leonard S. Patillo**

☐ **A brisk demand for products** is favoring the petroleum industry this year. It is now forecast that total demand for all oils in 1955 will be up a relatively sharp 6 percent over 1954. Domestic consumption is due to climb about 6.5 percent. Exports are due to decline. See **The Changing Panorama** for details ..... **Page 68**

EXPLORATION ARTICLES

☐ **A new exploration tool** which opens new possibilities in refraction shooting is described in the article beginning on **Page 79.** Excellent results can be obtained with a very low frequency seismograph with very modest charges of explosives. **VLF Refraction Method with Less Explosives Gives Excellent Results. J. A. F. Gerrard**

☐ **Stone corral in Kansas** is a good structure indicator. Here is an article that reveals results of a study conducted by the State Geological Survey of Kansas showing that structure maps on this formation reflect the Pennsylvanian structure with reasonable accuracy in 9 out of 10 fields studied. Fields selected for the study were relatively recent discoveries and are located in different structural provinces. Turn to **Page 84. Stone Corral a Kansas Structure Indicator. Daniel F. Merriam**

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

Looking Ahead . . .

. . . **Senators up for election will bear brunt of high-pressure** effort to defeat Fulbright Bill when Congress convenes in January. Mid-Continent Oil & Gas Association also expects powerful attempt in Senate to amend House-approved measure freeing independent gas producers of FPC control. This would force it back to House, where it might be beaten on next ballot. Measure originally squeaked through by only six votes. Encouraging aspect of present situation is that nation's press is not fighting it. Kerr Bill in 1950 was literally drowned in printers' ink.

. . . **Oil union will employ reverse technique** in impending campaign to organize professional and technical employes. Union has always approached each new unorganized element with confidence that it is needed and with neatly packaged sales pitch. But this time, says President Knight, ". . . our purpose is to determine if either or both these groups desire organization of any sort within the near future; if so, what sort of organization they desire, and what sort of contracts they want, giving what sort of protection."

. . . **Crude imports for third quarter will be up 15 percent** over 1954 period, IPAA predicts. Second quarter imports, said association, averaged 1,120,000 barrels per day, up 12 percent over 1954 period. Market for third quarter is expected to level off at 6,635,000 barrels per day, almost same as for second quarter.

. . . **California Standard will make pilot scale field test** of its own underground combustion method of secondary recovery. Method was developed by California Research Corporation, a subsidiary, and has been tested in Irvine-Furnace field, Kentucky. Four-well pattern will be used in new test at Midway-Sunset field near Maricopa, Calif. One central well will be used for injection of air to support combustion, and three producing wells will encircle injection well at distances of 200 feet. At end of 18 months, core holes will be drilled to observe effects. General Petroleum has announced similar test for South Beldridge area near Taft, Calif.

. . . **Construction barge to be used in Gulf by Humble** will assemble rigs from several large pieces. Barge is 90 feet wide by 300 feet long by 20 feet deep and will be equipped with two revolving cranes, one of 250-ton capacity and other of 40-ton capacity. Maximum load: One-third of rig. Rigs will be fabricated on shore.

. . . **Army engineers' impending study of hurricanes** on East Coast will eventually benefit offshore oil operators, who have long pointed out need for more protection. Weather Bureau has done tremendous job on stingy budget, but could use more radar, particularly needs weather ship in Gulf of Mexico.

. . . **Guaranteed annual wage plan could cost as much as 66 percent of payroll.** This is conclusion of study made at Northwestern University. Actual employment records of 31 production plants for the last ten years were used.

. . . **Oil pipe line companies' 1955 transportation revenues** will be up 8.1 percent at present growth rate. Sixty-six large companies reported transportation take of more than $304 million in first six months compared with 1954 period. Volume of oil handled was up 8.5 percent.

. . . **Method of numbering leases** will soon be used in all Texas Railroad Commission districts. Already installed in District 8, system consists of numbering each individual lease record or report filed with commission. Purpose is to avoid confusion in record-keeping.

. . . **Oil industry's capital expenditures will be almost $5.6 billion annually** for next 20 years. This is prediction of C. M. Vignoles, managing director of Shell-Mex and B. P., Ltd. He expects world oil demand to double by 1980.

23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

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EDITOR'S PAGE

There Is Hard Work to Be Done

An uphill battle is faced by natural gas producers in the fight to free themselves from federal government control. Passage by the House in the closing hours of the last session means little if anything. The vote was too close, 209 to 203.

Opponents of the measure will take full advantage of the interim. Foes, and there are some powerful ones, are certain to wage a vigorous campaign. They will exert tremendous pressure. These include the CIO, gas distributing companies, coal, city mayors in non-producing areas, and governors in some states.

Oil and gas producers must also seize upon the interim as an opportunity to better tell their story. To a large extent the success or failure will depend upon the degree of effort made by individuals.

•

It is unfortunate that politics now are likely to play an even bigger role in the fight against the legislation. This is an election year. Candidates may yield to the pressure put upon them if it is entirely one sided.

Moreover, in some areas candidates will find it expedient to campaign against the legislation for vote-getting purposes. Many of the mis-statements and untruths being used against the measure sound good to the uninformed public. Nothing is a surer vote getting platform in some regions than to "protect the public from the greedy oil and gas interests."

Even some candidates who may secretly feel the federal government should get out of the gas production business are apt to keep such ideas to themselves for fear of losing votes. Consequently, unless individual oil and gas producers do something, most of the political talk is going to be done by one side—those who favor government control for gas producers.

In passing the House by six votes, the Harris measure received a majority of the votes in the oil and gas producing states, Rocky Mountain states, and the Western states. The South and Southeast states were evenly divided. Big majorities went against it in the coal states, East, New England and Midwest states. In the latter group 156 congressmen voted against it, while only 80 voted in favor of it. It is in these areas that much of the work needs to be done, and it is here that producers will find it most difficult to accomplish much.

•

If gas producers are to be freed, they must speak up with the same degree of boldness and aggressiveness that will be used by their opponents. They must buckle down to a lot of hard work. Little time is left. An all-out campaign must be started now.

This is a task which will require the efforts of every oil man and employe. Hard work by a few will not be enough to swing the tide.

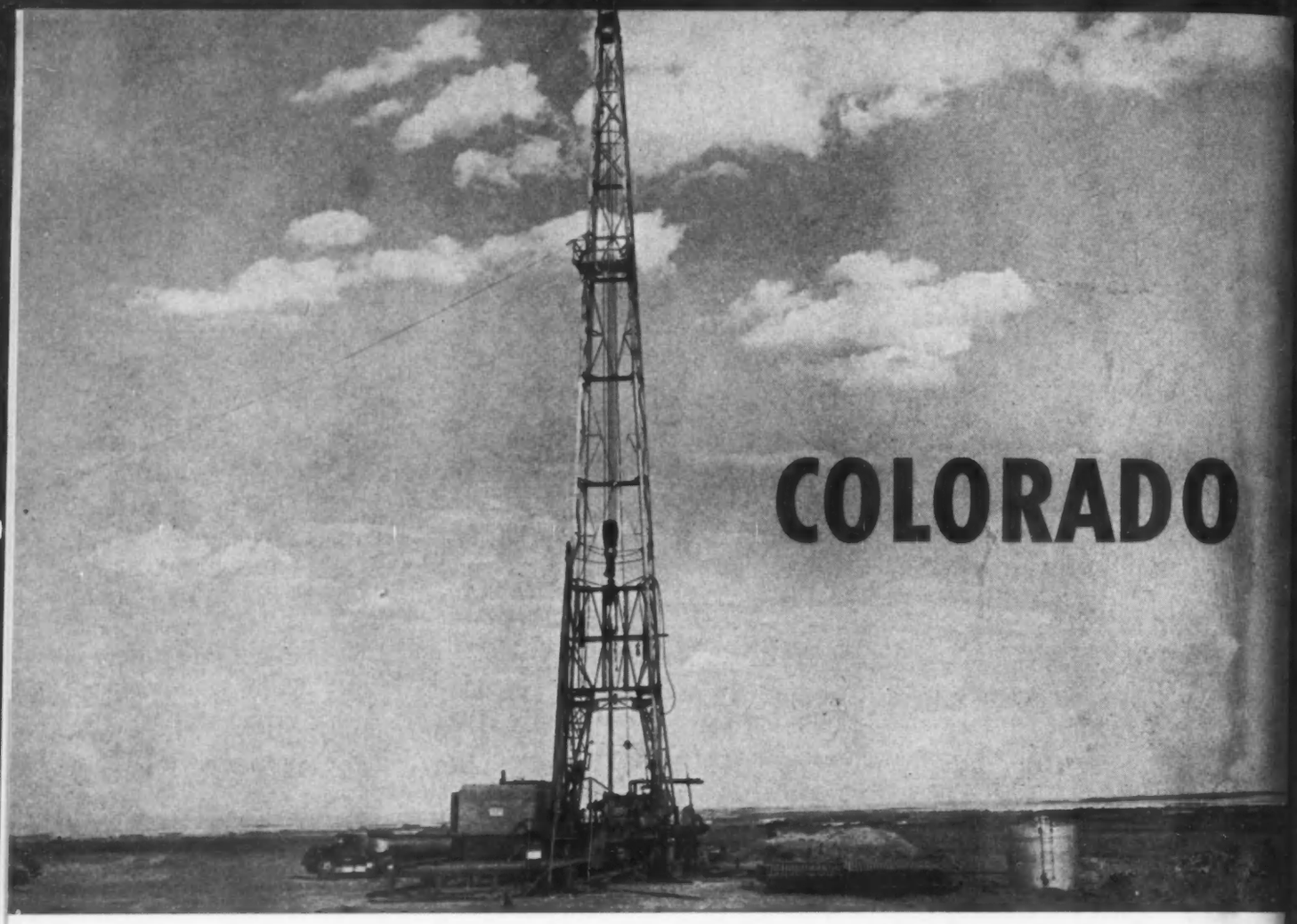
No producer should permit any mis-statement to go unchallenged. They should be corrected by every available means, letters and personal calls on individuals, newspapers, etc.

The sweeping dangers of the situation should be pointed out to every friend and relative, especially in the non-producing states. An avalanche of letters from every oil and gas producer could reach millions of people who otherwise might be misguided.

Employes of oil and gas companies need to be told what federal control of gas production would mean to the industry and the nation, so they will be in a position to do their share.

Only an all-out effort on the part of everyone will lead to success.

Warren L. Baker



Oil producer in the Adena field, Colorado. Next to Rangely, the Adena field is the most important in the state of Colorado.

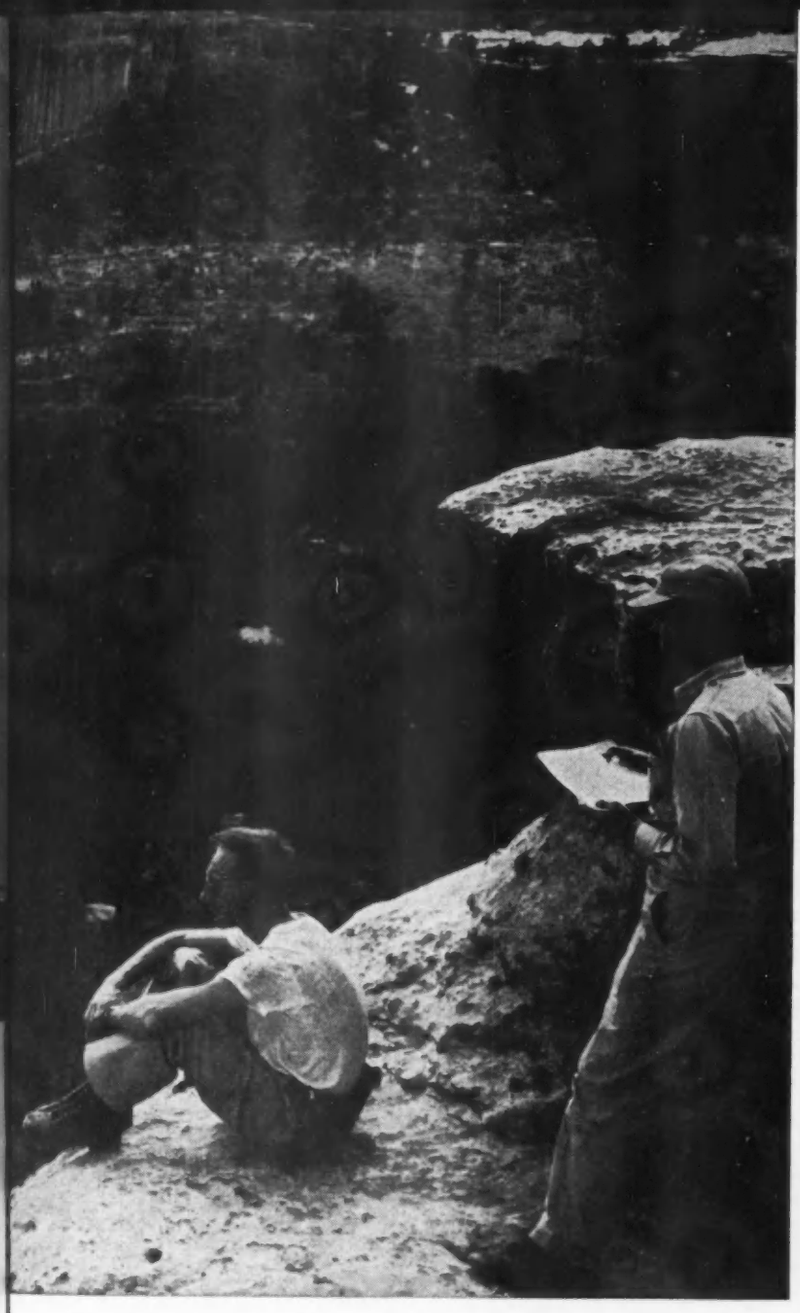
A BRIGHT OIL FUTURE

By R. D. SLOAN, Western Division Manager, The Carter Oil Company, Denver.

	B/D
1945	13,800
1946	32,500
1947	43,000
1948	48,800
1949	64,600
1950	63,800
1951	76,200
1952	83,000
1953	88,600
1954	112,500
1st 5 Mos. 1955	129,400
May, 1955	141,500

BARRING UNFORESEEN economic deterents, it is estimated that crude oil reserves in Colorado during the next ten years will increase from the present 328,651,000 barrels to 500,000,000 or more barrels and that production will increase from the present 140,000 barrels to 150,000 or more barrels per day. (Having substantial flush production, Colorado currently is producing at a comparatively high ratio to its proved reserves. For the future it is expected that there will be a tendency toward a more conservative ratio of production to reserves.)

Future possibilities for discovery and development of new oil and gas reserves in the state are excellent in many areas. Within the past two years a sharp upswing in discoveries peripheral to the vast Hugoton gas field in southwestern Kansas and ad-



Geologists work in pairs in the rugged Colorado plateau country

joining portions of Oklahoma and Texas has rejuvenated interest in Baca and Prowers counties of southeastern Colorado. The Greenwood gas field west of Hugoton has now extended across the Kansas line into Colorado, and during the next few years considerable exploratory activity should be centered in that portion of the state with a certain amount spreading westward into the Trinidad-Raton Basin area.

Along the western rim of the Denver Basin is a geologic province consisting of folded and faulted sediments. This Front Range foothills province has numerous oil seeps adjacent to the mountains and has produced oil and gas for many years from anticlines such as Fort Collins, Wellington, Loveland, Boulder and Clark Lake. Recent drilling has resulted in encouraging shows in the area west and southwest of Denver. Continued exploration in this mountain front area may well result in a number of future economic discoveries.

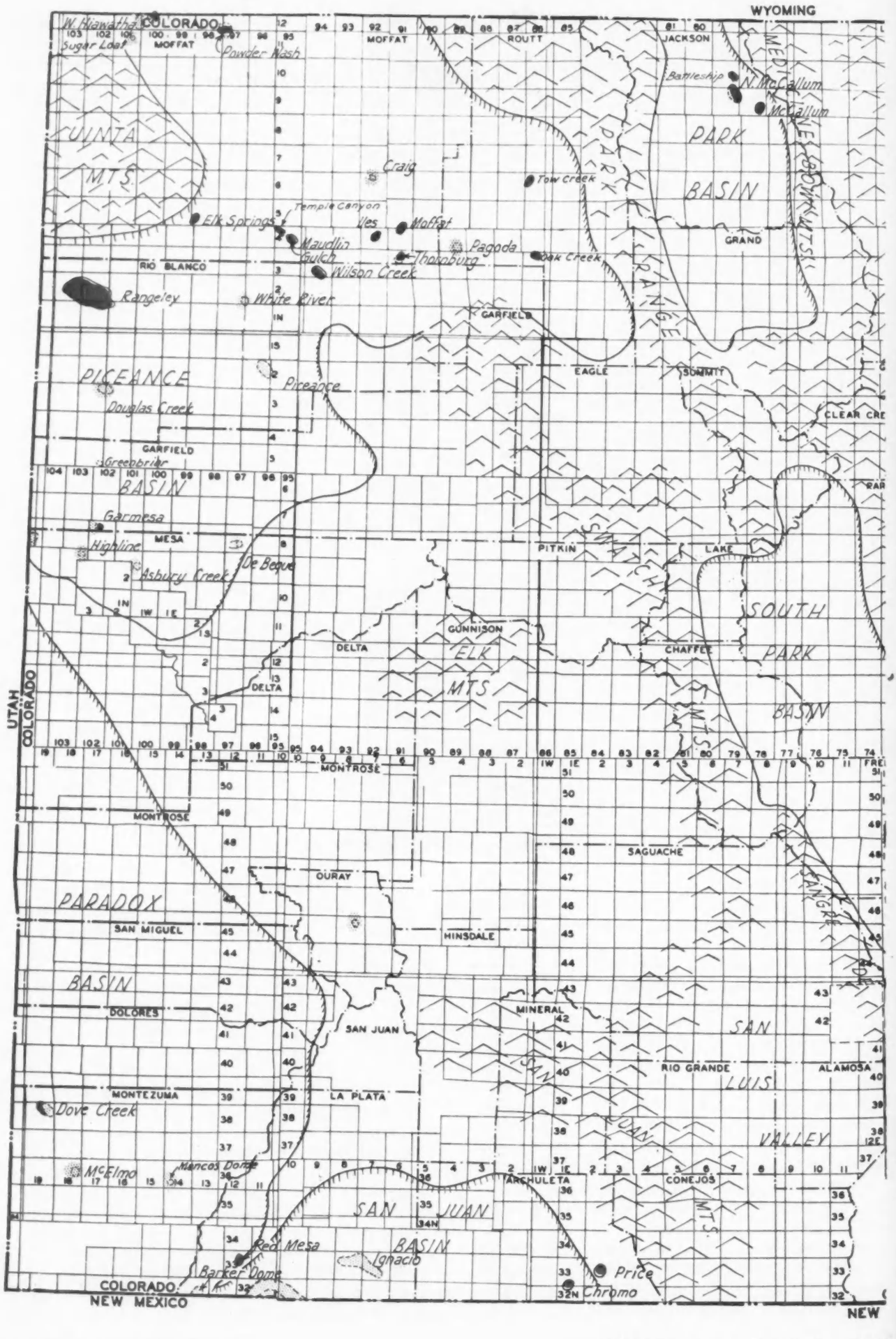
Since the 1949 Gurley discovery in eastern Denver Basin, exploration and development has spread rapidly southwestward into Colorado. In less than six years daily average production for this area has increased from 253 barrels per day to over 62,000 barrels for the Colorado portion of the Graneros trend. Continued increased activity is due in a large measure to the area's attractiveness to the independent operators and promoters. Over much of eastern Denver Basin the Graneros sand can be tested at depths between 4000 and 6000 feet and at costs ranging from $15,000 to $30,000. With increased outlets to Eastern crude markets, as provided by the Platte, Western and Arapahoe pipe lines, and with production and development appropriately supervised under the state's newly passed conservation law, exploration activity should continue at a high level in this area for several years.

To the west of Denver, the three Park basins—North, Middle and South—of central Colorado have received more than passing interest on the part of industry. North Park has been productive of oil since the discovery of McCallum in 1926, and only recently the 700 barrel a day discovery at Dwinell Ranch in Jackson County has again given impetus to the area. All three of the Park basins consist of downfolded and faulted remnants of marine sediments surrounded by lofty mountain ranges. Although these basins are rather limited in size and presently remote from industrial or marketing centers, they do offer numerous anticlinal folds and faulted structures to the enterprising and daring wildcatter. Time may well prove the basins as attractive for oil production as they now are for dude ranches, trout fishing and much-needed water.

The Piceance and Washakie (Sand Wash) areas of northwestern Colorado are structural basins having better than average oil and gas possibilities. Here are located a number of oil and gas fields, including Rangely, the state's largest oil field, as well as the largest shale oil reserve in the world.

Developments during the past several months have focused industry's attention on the Washakie Basin of northwestern Colorado and southern Wyoming. Encouraging shows of gas at Lay Creek, Shell Creek and Slater Dome in Moffat County, together with the prospective outlet afforded by the proposed Pacific Northwest gas pipe line, makes this area very attractive for future exploration.

Immediately to the south the Piceance Basin has geologic and topographic characteristics typical of Rocky Mountain intermountain depressions. Here a very prospective series of marine sediments have been protected from the rapid erosion which has denuded surrounding mountain ranges. Industry has given intermittent attention to this basin, with the more obvious anticlines such as Rangely and Piceance Creek Dome having been drilled years ago. De-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Temple Canyon
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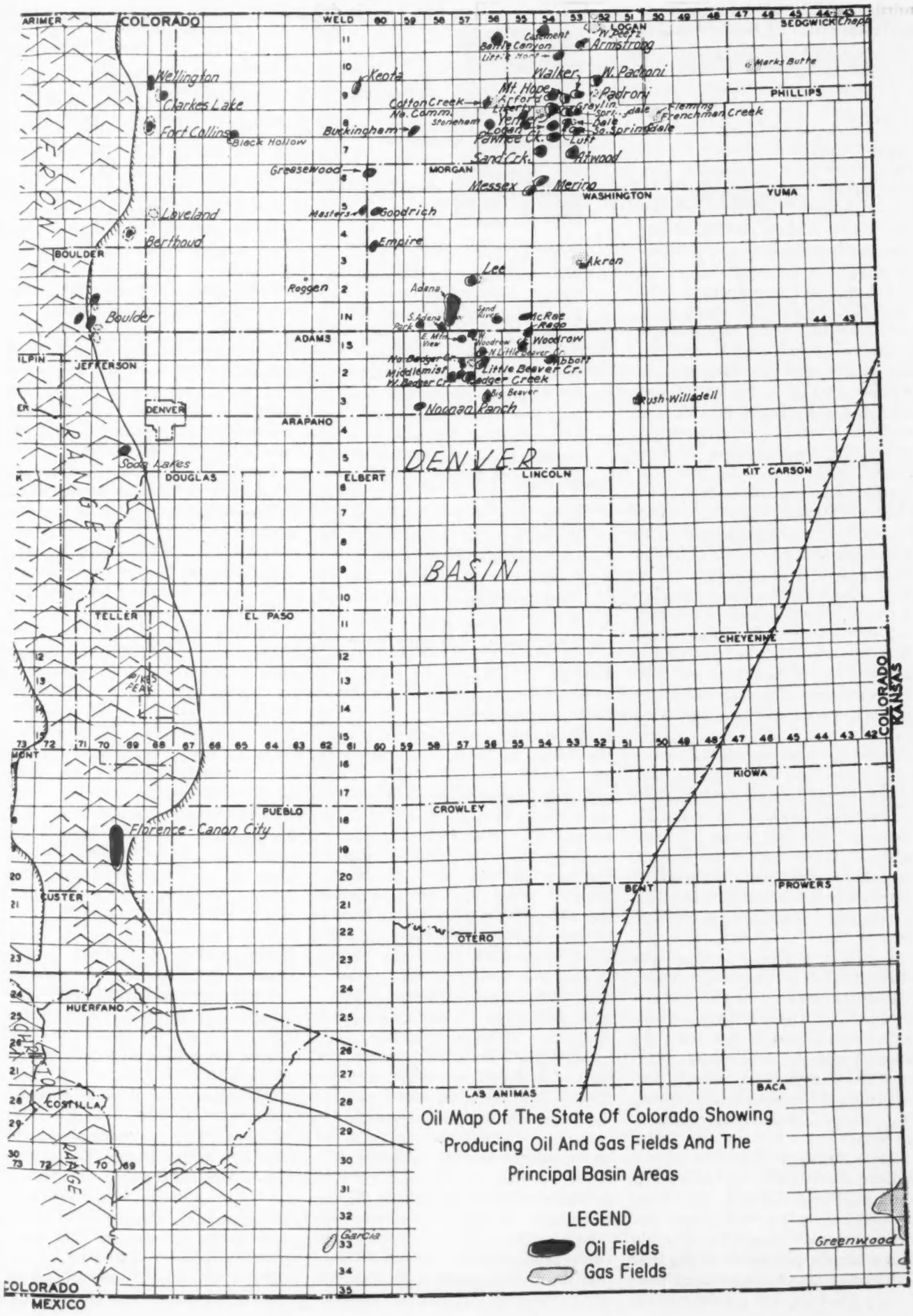
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Soda Lakes
Florence - Canon City
Walker
W. Padroni
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Mt. Hope
Cotton Creek
Sand Crk.
Messex
Merino
Armstrong
Woodrow
Little Beaver Cr.
Badger Creek
Nocaan Ranch
Rush-Willadell
Greenwood
Oil Map Of The State Of Colorado Showing Producing Oil And Gas Fields And The Principal Basin Areas
LEGEND
Oil Fields
Gas Fields

velopment drilling after discovery was slow in materializing because of lack of outlet. Wildcats presently projected for the basin, together with the completion of the projected Pacific Northwest gas pipe line, are expected to result in an upsurge of activity. This basin may eventually prove to be one of the state's most prospective producing areas.

To the south of the Piceance Basin is the Grand Valley area, consisting of a semi-circular topographic depression embracing the west end of the major anticlinal Uncompahgre Uplift of western Colorado. The topographic depression is the result of erosion of sediments of various resistance. Mesaverde and younger formations form the escarpment of the Book Cliffs and Grand Mesa. Resistant Jurassic and Pre-Cambrian outcrops form the highlands of the Uncompahgre Plateau. Between the Book Cliffs and the Plateau the soft Mancos shale, 3000 to 5000 feet thick, has been rapidly removed in terms of geologic time by the erosion activity of the Colorado and Gunnison rivers and their tributaries. The stratigraphic section in the Grand Valley consists of a highly prospective series of marine sediments. Structure for the most part is controlled by the Uncompahgre Uplift, resulting in numerous subsidiary folds and anticlinal noses extending into the Grand Valley area.

Production was established many years ago on these structural features. Oil has been found at Cisco Townsite, and gas is productive at Bar X, Westwater, Highline Canal, Asbury Creek, Garmesa and Twin Buttes. Early this year the discovery of oil at Sieber from the Morrison formation at a depth of 1439 feet did much to revive exploratory activity. It is anticipated that numerous wildcat tests will be drilled in the Grand Valley area of Colorado during the next few years, several of which should be productive of oil and/or gas. Like the Denver Basin, this area is particularly attractive due to the relatively shallow depth of the prospective producing horizons and the moderate drilling costs.

The extreme southwestern portion of Colorado includes parts of the San Juan and Paradox basins, which areas are well known for their present and future prospectiveness. To date the area is largely productive of gas from such pools as Ignacio and Dove Creek; however, oil possibilities are excellent, and no doubt many successful wildcat tests will be completed in the years to come.

About the Author

RAYMOND D. SLOAN, Western Division Manager for The Carter Oil Company, Denver, first joined Carter as a geologist in Lamar, Colo. in 1934. He attended Kansas State College and obtained a B.S. degree in geological engineering from Oklahoma University in 1933. Sloan is a member of AAPG, Rocky Mountain Section AAPG, Rocky Mountain Oil and Gas Association, District General Committee OIIC, and many other organizations and is listed in Who's Who In the West and Who's Who In Industry.

While viewed as relatively less attractive at this time, other regions of the state offer possibilities for oil and gas production. These include such areas as the San Luis Basin of south-central Colorado and the Maroon Basin in the west-central portion of the state. At such time as economics permit, Colorado's crude oil reserves can be further augmented by billions of barrels of shale oil from the Piceance Basin area. From the 72-foot Mahogany Ledge alone, presently being worked by the Bureau of Mines near Rifle, reserves are estimated at more than 80 billion barrels.

Wildcat drilling, one of the best yardsticks for gaging exploratory effort in a given area, continues at a high rate in Colorado. During 1954 some 657 wildcats were drilled in the state, representing 46 percent, or almost one-half of the total of 1440 wildcats drilled in the Rocky Mountain area. Of these exploratory tests in Colorado, 595 were dry holes, 42 were productive of oil, and 20 were gas discoveries, giving a success ratio of 9.4 percent. Of the 701 pool development wells drilled in the state during the year, 205 were dry holes, 444 were oil wells, and 52 were gas wells—a success ratio of 71 percent.

Rotary rigs active in Colorado during 1954 varied from 76 in April to a low of 44 in early September. Rotary rigs now operating are estimated at between 75 and 80, indicating that drilling activity is being maintained on a level comparable to that of last year.

Geophysical activity in 1954 continued at a record level with approximately 245 crew months of seismic work being performed throughout the state's prospective areas. Leasing activity during the year was directed to a large extent to the acquisition of acreage west of the Continental Divide, to the assembling of leases in the southeastern quarter of the state, and to continuing action in the Denver Basin portion of northeastern Colorado. Total acreage under lease in the state is estimated at 12 million acres. This compares with a figure of less than one million acres under lease ten years ago.

Expenditures by the petroleum industry in Colorado have increased steadily during recent years. In 1954 it is estimated that over $130 million was spent on wildcat and development drilling, lease acquisition, rentals, and geophysical exploration costs. Drilling expenditures alone amounted to over $64 million. One estimate places industry's total outlay in the state during the past year for exploration, drilling, production, refining and marketing operations at some $279 million. These estimates do not include transportation costs, management or staff overhead costs, and many hard to arrive at expenditures such as interest on loans.

Refining and Marketing Operations. Total capacity for Colorado's six refineries is placed at 36,300 barrels per day. During 1954 a total of 8,630,331 barrels of oil was processed through the plants for a daily average of 23,645 barrels.

According to estimates, Colorado consumed 568,070,000 gallons of gasoline in 1954. Assuming a gasoline yield of approximately 50 percent from each barrel of oil, the gasoline consumption during 1954 roughly approximates 74,112 barrels of oil per day—about one-half of the state's present producing capacity.

From the above figures it readily becomes apparent that Colorado is a

"Future discoveries in Colorado will depend largely on economic conditions."

net exporter of crude oil and a net importer of crude products. This situation has been brought about by the rapid increase in producing capacity during the past few years together with the fact that the crude discovered was not readily available to the established Colorado refining centers.

Crude Oil Reserves and Production. Ranking ninth among the states in the amount of oil produced during 1954, Colorado was 11th in crude oil reserves at the beginning of the current year. Proved reserves, according to figures compiled by the American Petroleum Institute, were 328,651,000 barrels as of January 1, 1955, or slightly over one percent of the total proved reserves of 29½ billion barrels of oil credited to the United States.

As the second largest oil producing state in the Rocky Mountain area, Colorado's daily average producing rate has shown a steady increase over the past several years, reaching 141,661 barrels per day on May 1, 1955. Recent production figures show that Colorado is now producing over 26 percent of the more than one-half million barrels of oil produced daily in the Rocky Mountain area. Accumulated production in Colorado to December 31, 1954, totaled 289,234,000 barrels of oil, of which amount 45,929,000 barrels, or 16 percent, were produced during 1954. From a national standpoint, the daily average production of Colorado accounts for roughly 2 percent of the present total daily average of 6,827,450 barrels being produced in the U. S.

The Rangely field in northwestern Colorado is today the largest pool in the state and one of the largest in the nation. Production currently averages in excess of 67,000 barrels per day, only a little less than one-half of the state's total production. At the turn of the year the pool had produced a total of 166,507,217 barrels of oil. The remaining reserves from 19,000 proved acres in the field are estimated at approximately 200 million barrels and may be even greater if and when secondary recovery methods are initiated.

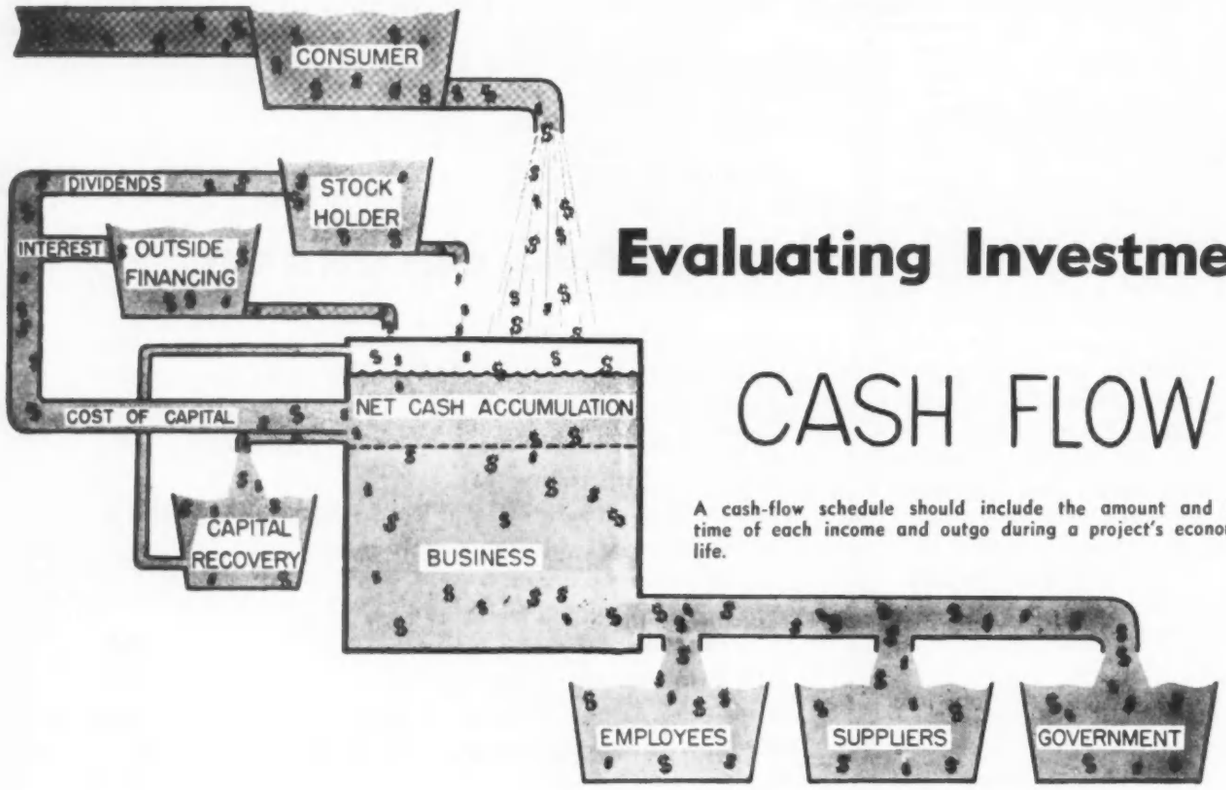
The second largest producing field in the state is Adena, located 60 miles northeast of Denver in the Denver Basin. Discovered late in 1953, there were but three producing wells by the end of the year. Activity rapidly increased and by the end of 1954 a total of 182 producers had been drilled and the producing rate was over 16,000 barrels per day through limited outlets. As of January 1, 1955, total accumulated production was 4,650,681 barrels. Recoverable reserves from the 12,000 proved acres in the field have been estimated at 40 million barrels of oil and 32 billion cubic feet of gas, with possibly an additional 50 percent recovery indicated through secondary recovery methods.

The Future. A critical examination of crude oil and gas discoveries in the U. S. during the last half century leads to the conclusion that discovery rates are dependent on three major factors, namely, (1) volume of exploratory effort, both wildcat drilling and geological and geophysical activity; (2) effectiveness of discovery methods; and (3) the availability of suitable territory for exploration. A lack of any one of these factors is sufficient to materially retard discovery rates.

Future discoveries in Colorado will depend largely on the economic conditions, controlling factor Number 1, as there is little question as to the prospectiveness of the area to be explored, and our finding "tools" were never "sharper" than they are today. In simple terms, it is the economic conditions which will govern the willingness or unwillingness of capital to accept the tremendous risks involved. Assuming an ability of industry to market oil and gas, a moderate tax structure, and favorable crude oil and gas prices, Colorado should have a brilliant future as an oil and gas producing state.

THE FACTS ABOUT COLORADO

Number of oil fields	126
Daily production (May, 1955)	141,661 barrels
Crude oil reserves	328,650,000 barrels
Total acreage under lease	12,000,000 acres
Number of oil refineries	6
Capacity of oil refineries	36,300 barrels per day
Estimated total industry expenditures (1954) in Colorado	$279,000,000
First oil well drilled in state, near Canon City	1862
Florence field discovered	1876
First natural gas discovered near Trinidad	1898
Shallow production discovered—Rangely, Rio Blanco County	1902
Boulder field, northwest of Denver, discovered	1902
North McCallum field, Jackson County, discovered	1926
Colorado ranks ninth in states in oil produced (1954). Total all-time production of oil in Colorado	289,234,000 barrels
(Of this total, 45,929,000 barrels or 16 percent were produced last year)	



Evaluating Investments

CASH FLOW

A cash-flow schedule should include the amount and the time of each income and outgo during a project's economic life.

By G. V. ROHLEDER, Chief Engineer, Okan Pipeline Company, Tulsa

MANAGEMENT TODAY is caught in the middle on capital outlay decisions. Faced with the task of harmonizing the divergent objectives of stockholders, consumers and employes, management executives are recognizing the need for a realistic program for *creating*, *measuring* and *selecting* opportunities.

But what are some of the elements of a capital outlay program? How should the economic worth of investment opportunities be measured?

Capital outlay can be defined as an expenditure of monies today for which the turnover into cash requires a period of years, and any benefits or profits are obtained from future operations. A capital outlay is necessary for the construction of new plants, additions, replacements, and modifications of existing plants. These long-term commitments as a rule establish a framework of policies upon which a company's success depends.

A capital outlay requires a forecast of the future. A great deal of risk is involved. Evaluation of these risks requires company-wide thinking, creative imagination, and judgment in predicting trends. Certain events can be predicted fairly accurately. Others can be forecast with less accuracy. Action is sometimes required when all the facts are not known.

Investment opportunities usually are analyzed by segments of the organization, but the final decision rests with top management. This situation points up the need for sound programs of evaluation.

Management is faced with a threefold task:

- Satisfying the three groups—stockholders, employes and consumers.
- Guaranteeing long-range survival of the company.
- Using its human and material resources at top efficiency.

Because of these conditions, capital outlays decisions are usually based either on profit or prestige. Even in those companies where the profit motive dominates, there are restrictions on the level of profits. These restrictions result primarily from competition—external and internal. There is external competition, when another company's trying to get the consumers dollars, and the government requires more taxes; internal competition comes from employes trying to increase their slice of the pie. As a consequence, the attitude changes from one of maximum profits to one of optimum profits and group satisfactions.

The prestige motive operates because a company wants to be known as one that does this-and-that for its employes, customers, etc. Good examples of investment from prestige motive are coffee lounges, modern offices, and recreational facilities.

In most companies, both motives are used to justify capital outlays. Whether the underlying motive is profit or prestige, management should make decisions on the basis of how much profit is expected, or foregone.

Elements of a capital outlay program. The success of a capital outlay program comes from management's conception and communication of five basic elements:

1. Management should set specific short and long term objectives (Master Plan). Objectives should be based on attainment intervals of 5, 10, 15 and 20 years or longer, and reviewed at specific intervals. These objectives should be set for organization, personnel, planning, profits, administration, costs, and betterment.

2. Management should develop a creative search for investment opportunities. Primary sources of ideas are the consumer, employes, competitors,

YARDSTICK FOR A CAPITAL OUTLAY PROGRAM

by the Discounted Cash Flow Method

Most desirable yardstick for measuring attractiveness of projects is the discounted cash flow method. It emphasizes all aspects of an investment. The more familiar payout method must be accompanied with supplementary data before a decision can be made. A third method, the accounting rate of return, presents many variables, which pose problems of interpretation.

stockholders, suppliers, and financial institutions.

3. Management should measure the economic worth of all investment opportunities by means of a standard yardstick for acceptance or rejection.

4. Management should select the best opportunities on the basis of their effect on profits, how they fit into the master plan, and how they affect the profit-volume relationship.

5. Management should establish a control for the follow-up on decisions, so that changes can be made when the dynamics of the environment warrants. This follow-up must be continued from creation to disposal.

Criteria for a good yardstick. The major need is to measure—to accept or reject the economic worth of investment opportunities. What is the basis of a good reliable yardstick?

1. A good yardstick is objective; that is, it measures both earning power and group satisfactions.

2. It pinpoints the relative position of various projects.

3. It considers all aspects of cash flow.

4. It summarizes in a single figure all the relevant data.

5. It is sensitive enough to allow for uncertainties.

6. It indicates whether the project earnings are below the minimum accepted level.

Use of estimates and assumptions. The analysis of an investment opportunity is a prophecy of the future. It can be evaluated exactly only if the analyst has a complete knowledge of future events. Of course, obtaining this knowledge beforehand is impossible. So we have to use reasonable and clearly stated estimates and assumptions. The accuracy of any of our evaluations depends more on estimating and predicting basic costs than on the mechanics of applying a standard yardstick.

Historical costs are valuable as a guide for estimating future trends. However, we should bear in mind that these past occurrences do not necessarily repeat in the future.

Another important consideration is the introduction of *safety factors* into components of the total estimate. Any safety factor is a deliberate error. Errors tend to multiply in any evaluation formula, thereby creating a greatly exaggerated error in the final answer. The person making the final decision does not have time or should not be expected to become aware of

About the Author

GILBERT V. ROHLEDER, a director and chief engineer of Okan Pipeline Company, attended St. Joseph's College and Military Academy in Kansas. During World War II he served with the Second Infantry Division, and in 1945 entered Massachuetts Institute of Technology, receiving his S.B. degree in mechanical and industrial engineering in 1948. He was with Service Pipeline Company from 1948 to March, 1955, when he joined Okan. He is now supervisor of all engineering functions in the design and construction of the company's pipe line systems.

Three methods of calculating economic worth are considered: (1) pay out, (2) accounting rate of return, and (3) discounted cash flow.

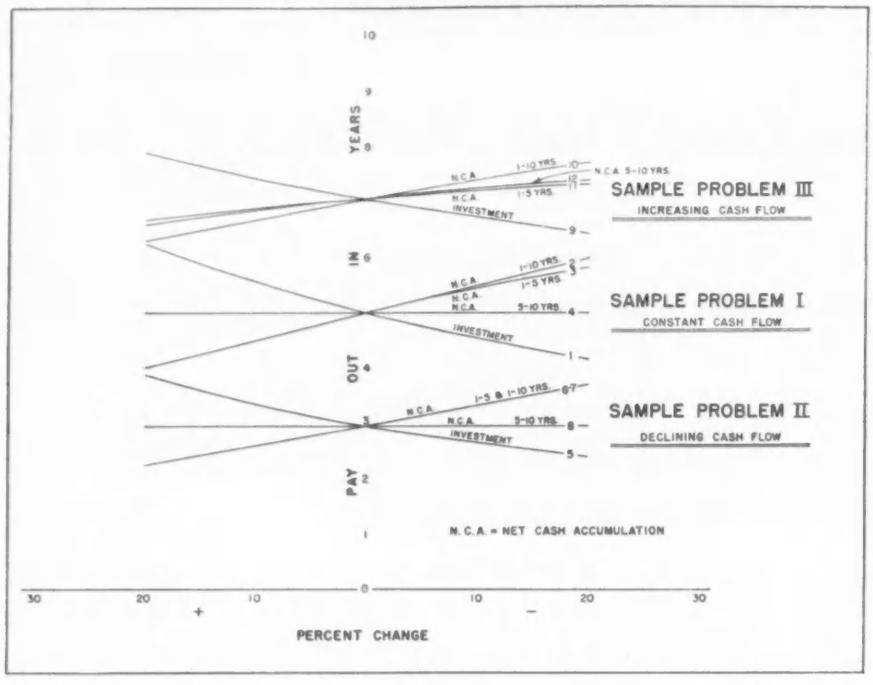


FIGURE 2

all safety factors introduced. Therefore, if any safety factor is to be used, it should be entirely managements' prerogative and applied when considering the final decision. It is entirely possible to "safety factor" a company out of business.

Preparing project analysis. A project analysis should include: (1) An estimate of the economic life; (2) An estimate of the cash flow pattern; and (3) An economic worth calculation.

Economic Life—A project's economic life is that period of time during which its profitableness is greater than any other known alternative. Factors that determine or fix economic life are:

1. Physical deterioration from the elements.

2. Depletion or exhaustion of an asset by piecemeal removal.

3. Wear and tear from use which cannot be restored by normal maintenance.

4. Inadequate capacity because of volume growth or changing demands.

5. Accidents caused by fires, floods, and explosions.

6. Obsolescence caused by technological improvements and innovations.

Improvements and innovations have occured so fast in recent years, that obsolescence has become the most important factor. Estimates of economic life can be made from actual mortality experience, projecting growth in volume and demand, projecting technological improvements, and projecting basic costs. The study of engineering valuation practices can provide the know-how for estimating all of the factors above.

Cash-Flow Pattern—A cash-flow schedule should include the amount and the time of each income and outgo during the economic life of any project. Figure 1 shows the cash-flow elements to be considered. Since at present a cycle of cash flow exists, only those changes in income and outgo resulting from a project need to be estimated. Statistical methods and probabilities play an important role in estimating, and may have to be used. Also, in our estimates, a plus sign indicates income and a minus sign, outgo.

Calculating Economic Worth—Three methods of calculating economic worth will be considered: (1) payout; (2) accounting rate of return; and (3) discounted cash flow. Let's use a simple illustration. Assume that a company has the opportunity to invest $20,000 in either Project 1, the purchase of a producing oil lease, or Project 2, the purchase of a new automatic machine, or Project 3, the purchase of a labor-saving jig. All three projects have the same life, and after considering yearly expenses, income taxes, etc., Table 1 shows the net amount of cash accumulated over a period of years.

The payout for each project is the number of years required to make the

TABLE 1

Time in Years	NET CASH FLOW		
	Project I	Project II	Project III
0	−20,000	−20,000	−20,000
0–1	+ 4,000	+ 7,600	+ 400
1–2	+ 4,000	+ 6,800	+ 1,200
2–3	+ 4,000	+ 6,000	+ 2,000
3–4	+ 4,000	+ 5,200	+ 2,800
4–5	+ 4,000	+ 4,400	+ 3,600
5–6	+ 4,000	+ 3,600	+ 4,400
6–7	+ 4,000	+ 2,800	+ 5,200
7–8	+ 4,000	+ 2,000	+ 6,000
8–9	+ 4,000	+ 1,200	+ 6,800
9–10	+ 4,000	+ 400	+ 7,600
Net Cash Accumulation	+20,000	+20,000	+20,000

cash accumulation equal to the original capital outlay. Payouts for each project are as follows:

Payout (I) =

$$\frac{20,000}{4,000} = 5 \text{ years, Payout (II)} =$$

$$\frac{20,000}{7,000} + 6,800 + \text{etc.} = 2.9 \text{ years,}$$

$$\text{Payout (III)} = \frac{20,000}{400} + 1,200 + \text{etc.} = 7.1 \text{ years.}$$

Accounting rate of return can be calculated several ways. First, by using the ratio of average yearly cash accumulation to original outlays, which would give in this case the same rate of return for each project,

$$\text{or: (I, II, III)} \quad \frac{4,000}{20,000} \times 100 = 20\%$$

Second, by using the ratio of average yearly cash accumulations to one-half original outlay. For I, II, and III, this

$$\text{would be } \frac{4,000}{10,000} \times 100 = 40\%.$$

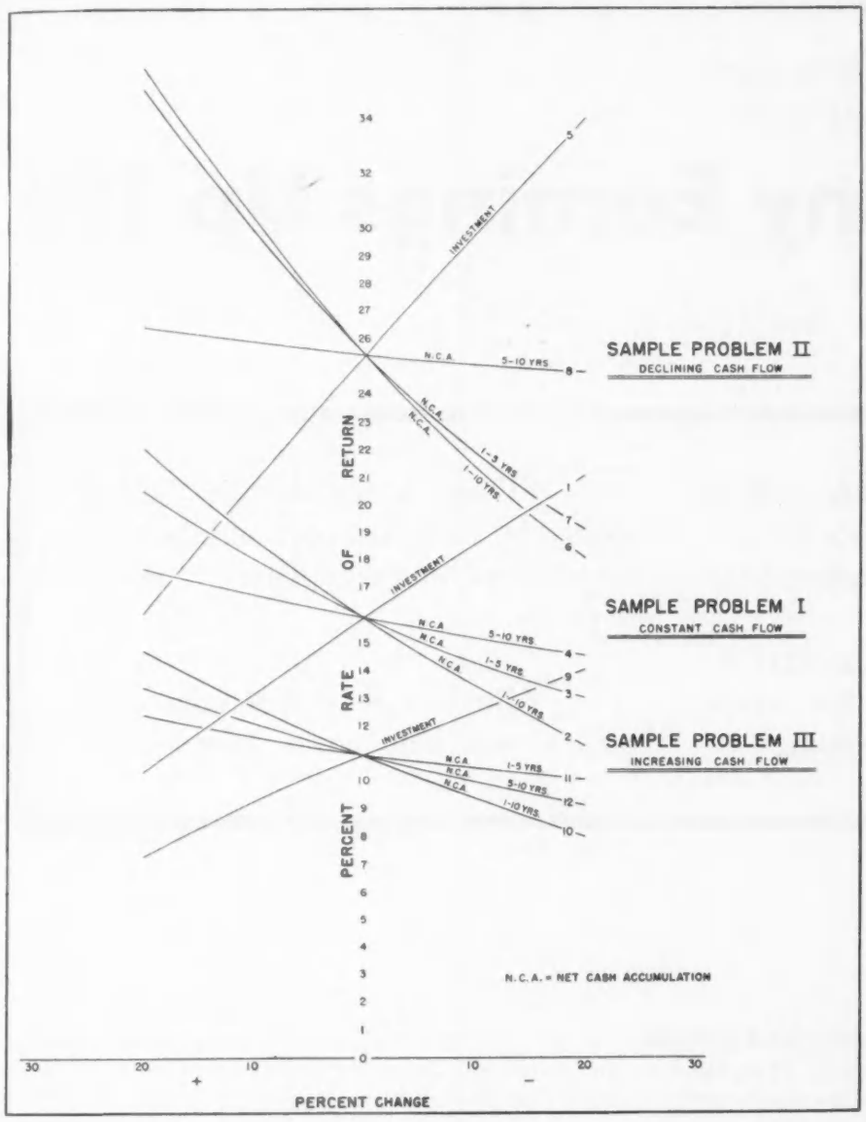


FIGURE 3

Other ways would be to deduct straight line depreciation for capital recovery from the yearly cash accumulations before figuring the return. For examples, in the problem above, it would be $\frac{4{,}000 - 2{,}000}{20{,}000 \text{ or } 10{,}000}$

This gives returns of 10 percent and 20 percent, respectively.

The discounted cash-flow method is a rate-of-return calculation expressed as a percent of the unrecovered portion of the investment. This method has a built in allowance for capital recovery. The rate of returns for the above projects using this method are: for (I) 15.9 percent; for (II) 25.4 percent; and for (III) 11.2 percent. To illustrate the method of calculation, let's use project II. All factors are obtained from a continuous interest table (see Figure 2).

Evaluation of three yardsticks. Now, how well does (1) payout, (2) accounting rate of return, and (3) discounted cash flow serve as a yardstick?

Payouts have the advantage in that everybody has become accustomed to their use. In those cases, where the economic life is the same, a fairly accurate selection of the most attractive opportunities can be made. They can serve as a rough indicator to determine if a more refined project analysis should be made. However, their disadvantages are many.

1. They stress the cash flow only during the breakeven period, and neglect any cash flow during the rest of the project life. Except for non-profit organizations, companies are not established just to break even, but to make some profit.

2. They do not provide an accurate index for ranking projects which have different economic lives. Since a company is likely to have many projects under consideration at a particular time, this factor is very important.

3. They discourage the use of trends and cash flow predictions over the project life. Neglecting trends and predictions can cause a premature disposal of facilities, an improper design, a lack of project flexibility, and large amount of modifications after installation.

4. They neglect the time value of money. After all, a dollar received or spent today is worth more than a dollar several years hence. A dollar today can be reinvested or used for current obligations.

5. They are not sensitive to changes in the cash flow pattern. Figure 3

Continued on Page 66

TABLE 2

		TRAIL RATE R = 22%		TRIAL RATE R_1 = 27%	
		Factors	Value (V)	Factors	Value (V_1)
0	−20,000	1.0000	−20,000	1.0000	−20,000
0–1	+ 7,600	.8975	+ 6,821	.8763	+ 6,660
1–2	+ 6,800	.7202	+ 4,897	.6690	+ 4,549
2–3	+ 6,000	.5781	+ 3,469	.5107	+ 3,064
3–4	+ 5,200	.4639	+ 2,412	.3898	+ 2,027
4–5	+ 4,400	.3723	+ 1,638	.3975	+ 1,309
5–6	+ 3,600	.2987	+ 1,075	.2271	+ 818
6–7	+ 2,800	.2397	+ 671	.1734	+ 486
7–8	+ 2,000	.1923	+ 385	.1323	+ 265
8–9	+ 1,200	.1544	+ 185	.1010	+ 121
9–10	+ 400	.1239	+ 50	.0771	+ 31
	.....	....	+ 1,603 (V)	....	− 670 (V_1)

$$\text{Rate of Return} = R + \frac{V(R_1 - R)}{V - V_1} = 22 + \frac{1{,}603\ (27\text{-}22)}{1{,}603\text{-}(-670)} = 25.5\%$$

Oil Company Earnings Up 11%

- Industry as a whole reflects gain for the first half of 1955. Similar increase indicated for complete year.
- Better profits in the first six months were achieved with the benefit of larger demand for petroleum.
- Outlook for the last half is clouded by increased costs of labor and materials without compensating rise in oil prices.
- But the increased volume of business will help cover added costs.

By L. J. LOGAN, World Oil Staff

In the oil industry it pays to have large foreign operations, and it also pays to have large-scale domestic operations. Some, though not all, U. S. oil companies with one or both of these advantages, are showing better than average earning power this year.

At the same time, above-average earnings are being achieved also by some smaller oil companies through exceptional success in producing or refining oil, as in the cases of Amerada Petroleum Corporation and Texas Gulf Producing Company, developing rich new reserves, and Lion Oil Company, profiting from new petrochemical refining facilities.

Five "international" oil companies of the U. S. in the aggregate earned about 14 percent more profit in the first half of 1955 than in the initial half of 1954, while 39 companies operating largely within the U. S. showed an aggregate increase of only about 6 percent. Together, the 44 "international" and "domestic" companies had an earnings increase of about 11 percent. (See table.)

Latter half outlook. For the latter half of 1955, there is now some uncertainty about the trend of oil industry earnings, although it is widely assumed that profits should roughly equal those of the initial half and show increases over 1954 similar to those in the first six months. If that assumption proves right, the industry's earnings for 1955 would be around 10 percent higher than those of 1954.

Clouding the outlook are the increased costs of doing business. Around the middle of this year, oil companies generally increased wage rates for their employes. And soon afterward, they were confronted with sharp increases in prices of steel, metal, and other goods purchased regularly in large volume. Other costs, too, are comparatively high. The industry continues to make heavy capital expenditures for new and improved refining and other facilities, and as the properties go into use, important deductions from income for depreciation are introduced into the oil company income statements. In 1955 many companies are making heavy expenditures for leases in the Gulf of Mexico, and earnings in the latter half of the year will reflect the important purchases of leases from the federal government in July.

Favorable earnings for oil companies will be promoted in the latter half, as in the first half, by record breaking volumes of business transacted. Demand for petroleum products has materially exceeded earlier expectations. In the first half of the year, the total demand for all oils was 7.1 percent greater than demand in the first six months of 1954. (See Page 68.) For the latter half of this year, the total demand is expected to show an increase of approximately 5 percent. In so far as volume of business is concerned, this estimate indicates that earnings will be buoyed somewhat less in the latter half than in the first half.

While volumes of business may be less sharply above last year in the latter half, there may also be somewhat less profit per barrel of oil han-

dled, because of increased costs of labor, materials, and other items.

Oil companies would like, of course, to be able to cover increases in costs by advancing prices of petroleum products. But so far there has not been any material change in average U. S. prices. Gasoline prices recently were increased fractionally on the Pacific Coast but were similarly reduced on the Atlantic Coast.

Oil vs. other industries. Although the oil industry is making a creditable record of earnings this year, it obviously is not making any excessive or extraordinary profits. This fact is emphasized by comparing its results with those of other industries and of business in general. The oil industry's earnings are up only about 11 percent this year, while profits of business in general are up about 30 percent and expected to continue to show similar gains over last year. For some major industries, earnings in the first half of 1955 were around 50 percent or more above those in the initial half of 1954. Those booming industries included the railroads, automobile manufacturing, construction, steel manufacturing, non-ferrous metal concerns, and textiles.

Other noteworthy increases in earnings were those of around 30 to 35 percent for drug manufacturers, rubber companies, tobacco companies, and chemical manufacturers. Gains of around 20 percent were recorded by the paper and radio-television industries and department stores. Several important industries showed increases in earnings similar to that of the petroleum industry, including the utilities, the air lines, distillers, electrical equipment manufacturers, and office equipment makers. Only a few industries, notably the food products concerns and some machinery manufacturers, registered smaller increases in earnings than the oil industry. Virtually no important industry showed any appreciable decline in profits in the first half of 1955 compared with the like period of 1954.

The large gains in earnings by most industries reflect booming business this year which contrasts with lagging business last year. Industrial production and business activity went

Net Earnings of U. S. Oil Companies in First Half of Year

COMPANY	1954	1955	% Diff.
COMPANIES WITH LARGE FOREIGN OPERATIONS			
Gulf Oil Corporation	$ 80,796,000	$ 91,871,000	+ 13.7
Socony-Mobil Oil Company	88,000,000	97,000,000	+ 10.2
Standard Oil Company of Calif.	104,043,923	109,342,748	+ 5.1
Standard Oil Company (N.J.)	293,000,000	344,000,000	+ 17.4
The Texas Company	97,480,845	*124,834,043	+ 28.1
	.....	†116,649,513	+ 19.7
Total, 5 Companies	663,320,768	*767,047,791	+ 15.6
	.....	†758,863,261	+ 14.4
OTHER COMPANIES			
Amerada Petroleum Corporation	8,041,986	12,196,634	+ 51.7
Anderson Prichard Oil Corp.	1,804,313	1,914,911	+ 6.1
Argo Oil Corporation	2,115,578	2,570,279	+ 21.5
Arkansas Fuel Oil Corporation	3,937,310	3,831,153	— 2.7
Atlantic Refining Company	19,851,367	18,882,687	— 4.9
Bishop Oil Company	87,616	158,283	+ 80.7
British American Oil Company	9,264,000	9,805,000	+ 5.8
Chicago Corporation	*3,396,724	3,603,013	+ 6.1
	†2,577,724	3,603,013	+ 39.8
Cities Service Company	19,455,609	23,540,627	+ 21.0
Continental Oil Company	21,859,000	22,172,000	+ 1.4
Houston Oil Company of Texas	3,118,467	3,739,229	+ 19.9
§Humble Oil & Refining Co.	74,742,700	88,284,000	+ 18.1
Lion Oil Company	6,067,300	7,816,987	+ 28.8
Louisiana Land & Explo. Co.	6,832,378	6,933,003	+ 1.5
Ohio Oil Company	19,493,031	19,550,571	+ 0.3
Panhandle Oil Corporation	503,767	366,019	— 27.3
Phillips Petroleum Company	37,918,723	42,575,770	+ 12.3
Plymouth Oil Company	3,349,639	3,894,991	+ 16.3
Pure Oil Company	14,016,000	16,081,000	+ 14.7
Quaker State Oil Refining Corp.	1,024,514	1,208,095	+ 17.9
Richfield Oil Corporation	12,393,626	14,635,379	+ 18.1
Roosevelt Oil & Ref. Corp. (Mt. Pleasant, Mich.)	139,335	330,167	+137.0
Seaboard Oil Company	3,423,510	3,543,844	+ 3.5
Shell Oil Company	63,435,549	54,497,284	— 14.1
Signal Oil & Gas Company	5,094,099	4,080,243	— 19.9
Sinclair Oil Corporation	36,515,125	37,801,184	+ 3.5
Skelly Oil Company	14,183,889	14,823,411	+ 4.5
South Penn Oil Company	3,141,214	3,477,541	+ 10.7
Southern Production Company	2,535,614	2,239,179	— 11.7
Standard Oil Company (Ind.)	53,042,928	64,964,743	+ 22.5
Standard Oil Company (Ohio)	8,044,035	*10,173,009	+ 26.5
	.....	†8,571,009	+ 6.5
Sun Oil Company	20,407,464	24,407,336	+ 19.6
Sunray Mid-Continent Oil Co.	‡18,696,679	17,628,546	— 5.7
Texas Gulf Producing Company	2,910,999	3,696,677	+ 27.0
Texas Pacific Coal & Oil Co.	3,999,515	4,121,411	+ 3.0
Tide Water Associated Oil Co.	18,167,000	18,022,000	— 0.8
Union Oil Company of Calif.	17,687,935	16,308,664	— 7.8
Universal Consolidated Oil Co.	769,990	1,007,777	+ 30.9
Wilcox Oil Company	273,321	430,583	+ 57.5
Woodley Petroleum Company	385,752	484,742	+ 25.7
Total, 39 Companies	*467,384,901	*497,513,972	+ 6.4
	†466,565,901	†495,911,972	+ 6.3
Total, 44 Companies	*1,130,705,669	*1,264,561,763	+ 11.8
	†1,129,886,669	†1,254,775,233	+ 11.0

* Includes non-recurring profit (Texas Co. and Standard of Ohio in 1955 and Chicago Corp. in 1954). † Excludes non-recurring profit. ‡ Includes separate earnings of Sunray Oil Corp. $11,522,813 and Mid-Continent Pet. Corp. $7,173,866. § Humble is excluded from totals, being included as a subsidiary of Standard Oil Co. (N.J.), which owns 86% of Humble Stock.

Comparatively small increase in profits indicates stability of oil industry. Domestic operations carry load for 5 U. S. "International" companies.

into a decline in the latter half of 1953, and the recession continued until late in 1954. For many companies, the large expansion of volumes of business this year has sharply increased profits.

Oil Earnings Stable. The comparatively small increase in profits in the oil industry in 1955 indicates that the industry has an exceptional degree of stability of operations and earnings through normal years, recessions, and booms. The industry is affected by contraction and expansion of general business activity and has to adjust its operations to the existing conditions. In 1953 and 1954 it had to cut down crude production and refinery runs because of lagging demand for petroleum products. In doing so, it went through a period of weak markets and some declines of prices. Nevertheless, petroleum products are highly essential, and even in 1954 there was a small increase in the total demand for all oils. With benefits of the continuing large demand for oils, the industry as a whole was able to show approximately the same earnings in 1954 as in 1953, whereas many other lines could not do so.

This year, with demand for oils up considerably, 35 out of 44 oil companies registered increases in earnings. But the percentages of increase were held down by the fact that the favorable 1955 earnings were compared with relatively good 1954 earnings. Oil's earnings are not up sharply this year, but neither were they down sharply last year. In this respect, the industry is similar to the utilities and the food products industry, which provide necessities and have relatively stable trends of operations and earnings.

International companies. There are five of the U. S. "international" companies. Besides being world-wide operators, they are also the five largest U. S. oil companies in terms of assets and earnings. And the fact that their combined earnings are proving relatively better this year than those of other oil companies in the aggregate apparently is based importantly on the large scale of their domestic operations. Two of the "international" companies, The Texas Company and Standard Oil Company of California, reported that their dividends from foreign subsidiary companies were about the same in this year's first half as in the like period last year. The Texas Company had an increase of 19.7 percent in first half operating profits this year, and as foreign earnings were unchanged, the gain was accounted for by domestic operations. Standard Oil Company (New Jersey) showed an increase of $51 million or 17.4 percent in earnings for the first half of 1955, and this record was made with important help from its large domestic subsidiary, Humble Oil & Refining Company, which registered an earnings increase of $13½ million or 18.1 percent. Jersey Standard derives about one fourth of its net income from U. S. operations, and about one fourth of its increase in profits this year came from the domestic operations. Standard of California had a 5.1 percent increase over exceptionally good 1954 earnings.

The other two "international" oil companies are Gulf Oil Corporation and Socony-Mobil Oil Company, and for the first half they showed earnings increases of 13.7 percent and 10.2 percent, respectively. Those gains are close to the over-all industry average, being better than for many companies but only about the same as for several of the large-scale domestic operators.

Domestic companies. The profitability of large-scale domestic oil operations in the first half of 1955 was attested by earnings increases of 22.5 percent for Standard Oil Company (Indiana), 18.1 percent for Humble Oil & Refining Company, 21.0 percent for Cities Service Company, 14.7 percent for Pure Oil Company, 18.1 percent for Richfield Oil Corporation, 12.3 percent for Phillips Petroleum Company, and 19.6 percent for Sun Oil Company.

In contrast with the above-average increases of those integrated domestic companies, over half a dozen other companies of the same category show below-average increases in earnings or decreases from last year. However, most of those apparently poor showings could be explained by special considerations involved. There were increases of 1.4 percent for Continental Oil Company, 0.3 percent for The Ohio Oil Company, 3.5 percent for Sinclair Oil Corporation, 4.5 percent for Skelly Oil Company, and 6.5 percent in operating profit for Standard Oil Company (Ohio).

There were decreases in profits of 4.9 percent for Atlantic Refining Company, 14.1 percent for Shell Oil Company, 0.8 percent for Tide Water Associated Oil Company, and 7.8 percent for Union Oil Company of California. A decrease of 5.7 percent is indicated for Sunray Mid-Continent Oil Company by comparing its first half earnings with the separate earnings last year of Sunray Oil Corporation and Mid-Continent Petroleum Corporation, which merged this year.

These below-average increases and decreases reflected various significant factors. For most of these companies, strict proration of crude production adversely affected income. For several companies, reported profit was held down by initial depreciation charges on important new refining or other facilities.

Atlantic and Tide Water were handicapped by continued depressed gasoline markets along the Atlantic coast. Union of California felt the termination of purchases of certain products by the government.

Sinclair had an exceptionally good year in 1954 and was not able to improve upon that record very much in this year's first half. The Sinclair management pointed out, moreover, that the industry faces an important problem in that costs have increased and the industry needs compensating increases in prices received for petroleum products. Sunray Mid-Continent apparently has reflected in its earnings the problems involved in merging two large oil companies.

—The End

System Needed for Wise Company Giving

- How much should you give?
- How should you handle telephone solicitations?
- How can you tell whether an appeal is legitimate?
- Here are some money-saving answers based on a business survey.

By LEONARD S. PATILLO

THERE WAS a time when the company chief executive could say "Sure, John, how much do you want?" when approached for seasonal contributions to one of the community's worthy organizations. And that was the extent of management thinking which had to go into the problem of corporate giving.

But that time has passed.

Fund-raising no longer follows a seasonal pattern. And requests for company giving are multiplying daily. There seems to be an ever-increasing avalanche of worthy causes to which to contribute.

How to handle such requests courteously, intelligently, and with the proper degree of uniformity has become one of management's most perplexing public relations problems.

Every company is called upon to share in the responsibility in aiding community and civic well-being. To meet that responsibility, money and often manpower are prime requirements.

More and more companies feel that sharing in the support of such worthwhile causes is a part of being a good citizen and a legitimate part of the cost of doing business. Executives tend to give and give generously, but demands of other duties may cause them to give unwisely and too hastily unless they have a formalized plan.

The problem is complex enough in the large company operating in a small community, but it can assume nightmarish proportions unless some policy or method of operation is developed by companies operating on the regional, state or national level.

Oil Industry Headaches. Because of their widespread operations, oil companies and allied industries are finding their headaches growing larger and larger as they try to cope with the problem.

Unless company-wide thinking goes into the operation, a company might find itself in the position of one such firm, which has a multitude of branch offices. The company delegated one of its executives to join the community's leading service club, thereby setting a precedent. Executives on a similar level in the branch offices requested—even demanded—that they be permitted to do the same.

Company officials, to their amazement, discovered that the initial modest membership fee had magnified itself to an expense sheet item of sizable proportions.

While memberships may not be classified by all companies under "giving," it is an example of giving.

Others confronting busy executives are:

How much to give?

How can we avoid disruption of company operations during fund drives?

How to handle telephone solicitations?

How to tell whether a drive is legitimate or not?

TMA Sought Answers. The Texas Manufacturers Association, through a survey of its membership, tried to find the answers to these questions. Many companies responded with their plans of operations, happily reporting that even though most of them were established in self-defense, they don't now see how they got along without them before.

But, at the same time, TMA discovered there is no hard, fast rule for handling contributions and that many firms are still "flying by the seats of their pants" when it comes to corporate giving.

These are the firms who suddenly discover toward the close of the year that they've reached the limit of what they had planned to give and still have several worthwhile charities to which to contribute.

Then, too, in checking over their list of contributions, they discover several in the doubtful class when it comes time for tax deductions.

Evidence of this perplexing public relations problem was brought out by John Mortimer in an address in Houston before the Dixie Conference and Exposition of the National Office Management Association.

Mortimer, director of public relations for U. S. Steel Corporation's Gulf-Southwest District, had this to say:

"I think it goes without saying that none of us knows too well as yet what degree of participation is a fair load; either in money for worthy causes, or in talent for affairs that require manpower.

"It seems that somewhere along the line we must devise a system that will show exactly what our obligation amounts to in the various civic undertakings of our communities."

Companies Battling Problem. Mortimer and U. S. Steel aren't alone.

Many companies with excellent public relations programs are battling the problem constantly. Many firms which previously have handled contributions on a "hit or miss" basis are now "testing out" formulas.

Corporate giving may be classified into a myriad of categories: relief and help, public welfare, social betterment, educational institutions (scholarships, fellowships and specific research projects), and business organizations and trade associations. This list may be multiplied many-fold.

But for the survey, TMA asked Texas firms these main questions:

- Do you have a special plan for donations?
- What official has final "say-so" on management contributions?
- Employe solicitations?

The answers fall into two main groupings: How Texas companies handle corporate giving and, second, how employe contributions are handled.

Fund Committees Increasing. There seems to be an increasing number of contributions committees coming into existence. They differ somewhat in organization from company to company, but their basic objective is the same: "To provide for equitable distribution for religious, charitable and educational purposes of an annual budgeted amount allocated for this purpose."

Such committees ease the burden normally falling on top executives who receive the bulk of contribution requests. Top management generally prefers to keep control of contributions strictly within its own hands, but the investigation has been done prior to the airing of the requests before them.

Committees, too, can deal authoritatively with the question of, "How much to give?"

One oil company asks these questions, which seem to be basic:

How much will the company and its employes and stockholders benefit? How much is sought? What seems to be the company's reasonable share? What are our competitors and other companies giving? What is the size of the community and size of company operations? Is there any relationship between the employes and the amount we should give?

A West Texas company with operations in ten communities in four states told how his firm handles company-giving.

"A total sum is set aside in our annual budget to cover all donations . . . An arbitrary percentage (about 30 percent) is set aside for contributions to national organizations which normally solicit from national headquarters. This portion is administered by the president's office.

"Balance of the fund is allocated for expenditure in the ten communities . . . in direct relation to our capital investment in each community . . . We are now in the process of placing administration of these funds under our local manager in each community.

"We feel that the capital investment basis for establishing donation ratios in various communities has been of considerable assistance in gaining the understanding and acceptance of the various charitable institutions with whom we have dealings."

But many companies with widespread operations are carrying the procedure a step further and figure in the number of employes.

One company in the oil equipment field, in its policies on memberships and contributions, limits "giving" to "communities having at least three salesmen, and an office, shop or warehouse, with at least one full-time employe, providing the firm is operated as a regular business establishment."

Here again there would naturally be great divergence between policies of different companies in different business classifications. But, an official of a company with statewide operations sized up what may be a workable formula when he said his company's contributions were based on the scope of operations in the community, figuring in number of employes, plus how much other companies were donating.

This rule cannot be adhered to in every case, for it is apparent that companies which are the dominant industry of a community might tend to give more than under a similar capital investment-number of employe situation in another community.

How Committees Work. Getting down to examples of how contributions committees work, one might refer to the operational organization of another industry with state-wide operations. Its outlets are in practically every city of Texas and, consequently, the question of "To Give or Not to Give" has become one of increasing public relations importance.

This company has a three-member contributions group which operates at the board level. It passes, without board approval, on corporate donations, after investigations, up to $250. All requests for donations from throughout the state are received by the group which consists of two vice presidents and a director, with the assistant to the president serving as secretary.

It assembles requests, investigates them, and presents its findings to the board of directors on all those above $250. Because of the company's extensive scope, the board must give considerable thought to whether or not a contribution will set a precedent and by so doing set off a costly chain reaction.

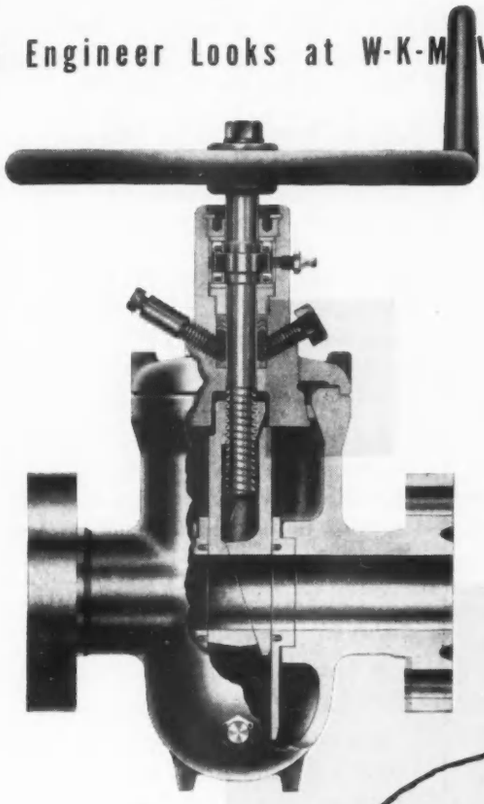
The company particularly watches to see if the cause is "accepted" by other businesses of the community.

The director of industrial and public relations serves as chairman of a three-member memberships and contributions committee of another oil field equipment company. Its functions are "to act as an administrative committee, make policy recommendations, establish control procedures, make annual report, and make budget recommendations."

In this company, the chairman serves as a clearing house for all requests. It's his duty to see that all requests are investigated, maintain appropriate records, prepare the draft of budget proposal, and to administer control procedures.

Each activity approved must be sponsored by a member of the firm's operating committee. The sponsor, in turn, is responsible for keeping informed of the purpose and activities

An Engineer Looks at W-K-M Valves . . .



W-K-M Bonnet Flex-Float Ring* Seals Tight Regardless of Pressure and Temperature Variations

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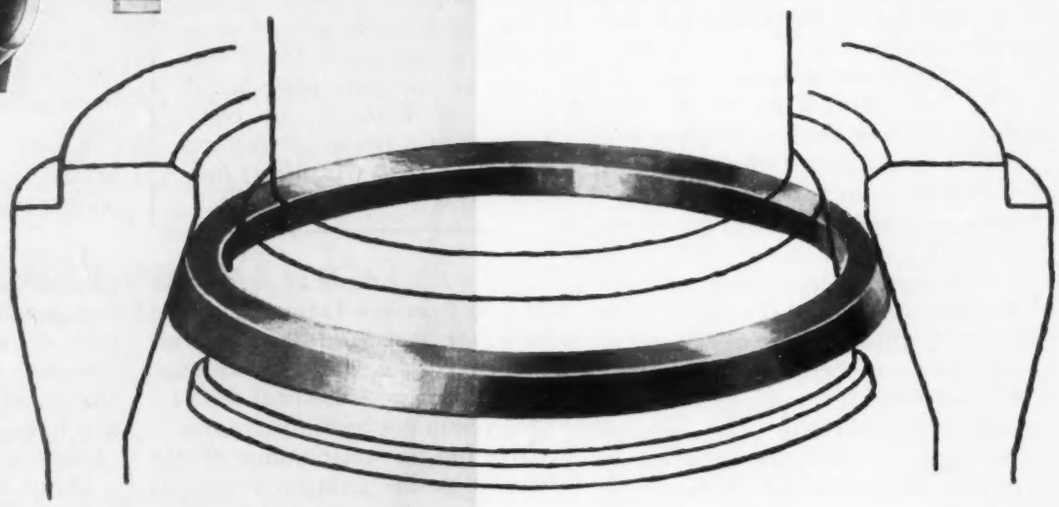

Pressure changes, temperature changes and changes in stresses force the W-K-M Bonnet Flex-Float Seal Ring into closer engagement with its seat, thus always maintaining a tight bonnet seal.

Conventional ring joints require excessively high stud and bolt tensions to deform the ring to the point where the residual seat load is above that required to make a fluid-tight seal. But line pressure and temperature variations can quickly lower this residual load and cause leakage. This is not possible with the W-K-M Flex-Float Seal Ring, whose seat load increases as the pressure and/or temperature goes up.

This type of ring has been used in W-K-M valve bonnets for 10 years.

For full information ask your W-K-M Sales Engineer.

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W-K-M Valves

of the sponsored project; determining the value or worth of the services to the company; reporting annually to the committee, and assuming the cost within his own departmental budget.

Another firm, whose territory covers more than a score of states, has outlined its contributions' policy in a six-page mimeographed manual. Among the many points covered is its contributions procedure.

Contributions' Policy. "A contributions committee comprised of headquarters personnel approves the contribution budget after recommendations have been made by field supervisors through proper organization channels to various regional general managers. The budget, after drawn up by the committee, is approved by the chief executive officer. Contributions are administered wherever possible at the local level, subject to the budget.

"Unusual cases are passed from the local level where they originated through proper channels to the public relations department, which then gets a decision from either the contributions committee or chief executive officer."

Still another large company sends donation requests to the public relations repartment. The department, in turn, takes up the requests with various departmental managers or vice presidents affected. This national firm has no committee organization as such on the regional level.

Composition of the contributions committee of a Fort Worth firm is the company's five director-officers who decide by plurality vote what contributions will be made and what employe solicitations may be conducted.

A Dallas manufacturer has two plants in operation, one for the employes' contributions and a second for corporate giving. Members of the second group are the public relations coordinator, director of industrial relations, and manager of manufacturing control. After requests are investigated, the committee makes written recommendations to the vice president-comptroller. If he approves the recommendations, he initials the written report and checks are mailed out by the public relations coordinator.

About the Author

LEONARD S. PATILLO, of Houston, is now manager of the magazine *Houston*, published by the Houston Chamber of Commerce. At the time he wrote this article herewith, he was director of public relations for the Texas Manufacturers' Association, a statewide business organization with some 3300 business and industry members. He has been engaged in public relations and publicity work for the past 14 years, except for serving in World War II as an Air Force navigator. A native of Kentucky, he began writing as a newspaper reporter on the Paducah (Kentucky) *Sun-Democrat*.

If there is any doubt as to the committee recommendation, the vice president-comptroller refers the request data to the executive vice president and treasurer for final decision.

The committee bases its recommendations on the relationship of the charity to the company and its employes, and on a predetermined budget set up by the board of directors.

Few Written Policies. It is surprising many companies with good management principles in other divisions have no written policy on contributions and donations. But the trend is in that direction.

When financial analyses are made, they point up the fact that corporate giving is often a sizable business expense.

In outlining his company's general policy toward contributions, one president said: "All possible contributions must come within the limits of the law: 'To make donations for the public welfare or for charitable, scientific or educational purposes.'

"But there are other tests: Does it benefit the business and/or company employes, either directly or indirectly, and therefore benefit the stockholders? (Company funds actually belong to the stockholders.)"

Giving Important to PR. He went on to stress that "Regardless of whether those requests are referred to others for action," in writing to his supervisors, "or handled at the local level, every supervisor has a responsible role . . . often the manner in which the supervisor handles the original request is an important test of our entire public relations activity."

In processing requests, he urged supervisors to keep these points in mind, for they are highly important to good public and community relations:

- Answers to requests should be given at the local level if possible.
- Answers to requests (yes or no) should be prompt.
- Avoid any impression that decisions regarding contributions are made at headquarters.
- Take responsibility for decisions at the local level insofar as the budget will permit.

There is always a question of whether a request is from a worthy organization. No doubt most charitable drives are legitimate, but a few "lemons" always creep in. How do companies decide which campaigns are being staged for legitimate causes?

Many Texas companies, particularly those with formalized giving programs, help their top officials decide on merits of campaigns simply by asking for detailed accounts of the drive's purpose, how much is allocated to campaign expense, and similar information. Some companies seed this data through the use of a questionnaire.

Ask for Details. It's good business, they find, to ask any organizations seeking contributions for complete details of its operations and what they plan to do with the money they are asking the companies to contribute.

One company keeps these points in mind when considering a contribution and seeks the answers before making its decision:

Will the contribution benefit the company directly or indirectly? Does

58 Bethlehem Supply Stores

serve the
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Remember when you actually had to *hunt* for a Bethlehem Supply store?

We were the baby of the oil fields then. But babies have a way of growing up. Now there are 58 Bethlehem stores, all fully stocked for local needs, and they cover a lot of territory. They serve an area that extends from California to east of the Mississippi . . . and from the Gulf Coast to Canada.

These stores carry the latest, most modern types of machinery and supplies—everything from valves and fittings to drilling equipment and pumping units. Want some hose or pipe—fast? Your Bethlehem store has them! Gaskets, sucker rods, bottom-hole pumps? Just pick 'em out of stock!

But there's something else you'll find. It's *people* that make a supply store tick. It's people that render the service and the courtesies. Bethlehem stores are run by friendly people, men who wish to help you and make you feel at home. So come on in—you're welcome if you only want the time of day!

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Castaic, Long Beach
Los Angeles, Santa Maria
Taft, Ventura

COLORADO
Fort Morgan, Sterling

ILLINOIS
Grayville, Salem

KANSAS
El Dorado, Great Bend
Medicine Lodge
Russell

LOUISIANA
Harvey, Houma
Lake Charles, Morgan City
New Iberia, Shreveport

MISSISSIPPI
Laurel

NEW MEXICO
Artesia, Hobbs

NORTH DAKOTA
Tioga

OKLAHOMA
Bartlesville, Duncan
Lindsay, Oklahoma City
Seminole, Wewoka

TEXAS
Abilene, Alice
Beaumont, Borger
Charlotte, Corpus Christi
Graham, Houston
Kermit, Kilgore
La Ward, McAllen
Midland, Odessa
Pampa, San Angelo
Snyder, Sundown
Sweetwater, Whitesboro
Wichita Falls, Winnsboro

WYOMING
Casper, Newcastle
Thermopolis

DISTRICT AND SALES OFFICES

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Los Angeles, San Francisco

COLORADO
Denver

ILLINOIS
Salem

KANSAS
Wichita

LOUISIANA
Harvey, New Orleans
Shreveport

OKLAHOMA
Ardmore, Oklahoma City
Ponca City, Tulsa

TEXAS
Corpus Christi, Corsicana
Dallas, Fort Worth
Houston, Midland
Pampa, San Antonio
Wichita Falls

WYOMING
Casper

it duplicate effort of other organizations or groups? Is the purpose of the soliciting agency a good one and does the organization have widespread acceptance and support? What constructive result does it accomplish? Does it aid a reasonable proportion of the general public, or is it very restricted in its operations? Are other companies in the community supporting the drive and if so, how much are they giving? Is it best served by private giving or should it be financed by public funds? Is the agency of broad influence rendering services that are representative and public in character? Are the people heading the organization first-rate? Are its fund-raising methods sound? Are costs of raising funds and administration reasonable? Does it operate under budgetary control? Will the contribution advance the community and public relations of the company?

When a company is in doubt about an organization, officials should check with the local Chamber of Commerce or Better Business Bureau. Then, too, another source for checking is the National Information Bureau, Incorporated, 205 East 42nd Street, New York 17, N. Y.—a membership organization which publishes an annual Givers' Guide and will supply to its members a confidential report on specific appeals or causes.

Fewer In-Plant Solicitations. Management has in recent years been frowning more and more on "in-plant" solicitation. In companies reporting to TMA's survey, the trend seems to be toward a one-time solicitation each year.

Companies with formalized programs are restricting in-plant solicitation to the United Fund or Community Chest and the American Red Cross. And these solicitations are handled by company employes themselves.

They report this approach causes less costly work disruption and usually results in more employe giving.

Some companies are moving toward deduction plans for all employe contributions. This approach, several reported, has also increased contributions on the part of the employes.

A Sherman, Texas manufacturer has had an unusual plan in operation for four years. Called the "Good Neighbor Day," the plan is conducted one day in October each year. Employes are afforded an opportunity to work four hours overtime and are paid time and a half. Earnings (equal to six hours) are contributed to the firm's "Good Neighbor" Fund. The company matches the employes' contributions with the profits for one day's operation. If a man is absent, he is given a chance to work four hours at some other time.

Deduction Plan. A Dallas company has had a payroll deduction plan in operation for many years. During World War II, deductions were one-half percent; since the war, one-quarter of 1 percent. The employe, upon hire, signs authorization for the deduction.

The fund is administered by a board comprised of one member from the office and one each from the seven major plant departments. Members are nominated and elected annually by ballot.

Whether companies have formalized plans or not, one point of agreement came out loud and clear. That was on the subject of telephone requests. Officials queried have set a fixed policy of taking no official action until the telephoned request is confirmed in writing.

The committee operation is particularly helpful in this instance, for the chief executive can tactfully and authoritatively ask for the information in writing if he is telephoned. Such action assists in determining how much to give and whether the campaign is legitimate.

The committee plan seems to work in every firm where it is in operation. Through such operation, proper investigation of contribution requests can be made in a business-like manner. More attention can be given to this increasing expenditure of the business dollar. Contribution requests may be studied. They are a dollar-and-cents part of the over-all business operation.

Forecasting the Future

Continued from Page 53

shows the payouts for problems I, II, III, if certain changes occur in the cash flow pattern.

6. They cannot indicate whether minimum earning levels have been obtained.

Accounting rate of return does measure the earning power of a project. There are many variables which must be reconciled and accepted before its use is worth while. Capital recovery can be provided for, and an indication can be obtained, as to whether minimum earnings level has been met. The use of this method makes it difficult to determine the relative attractiveness of projects.

Also, it isn't very sensitive to changes in cash flow and does not consider the time value of money. Another difficulty is in the use of averages. There are many types of averages. These averages vary, depending on the time period considered. For example, the average investment tie-up, using straight line recovery, over a five-year period is .6 of the original investment. For a ten-year period this average is .56.

Discounted cash flow overcomes these disadvantages by concentrating on the project's lifetime earnings, allowing for capital recovery, and by weighing the time value of money. Because of its sensitivity and direct measure of earnings, it allows for the accurate ranking and selection of projects. Minimum earnings level can be established in terms of percent on the investment. By projecting the cost of capital—what the company must pay to attract the investors dollars—management can raise or lower the minimum accepted return. Figure 4 shows the sensitivity to changes in cash flow.

Conclusions. As a rule, payouts have to be accompanied with supplementary data before a decision can be made. The many variables associated with the accounting rate of return present quite a problem of interpretation. Both methods are more commonly understood and used than discounted cash-flow. Most people are not too familiar with discounted cash flow; however, this method is the more desirable one because it emphasizes all aspects of a given capital outlay. —**The End**

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AK-711

Sharp gain indicated in private and commercial motor vehicle gasoline use

change in demand in the third quarter, and a gain of 5.3 percent in the fourth quarter of 1954.

Gasoline Use Jumps. The increase of 6.5 percent forecast for domestic oil demand in 1955 shows considerable variation by products. The gain of 5.8 percent forecast for gasoline, after a relatively small annual gain of 2.7 percent in 1954, indicates a sharp rise in private and commercial motor vehicle consumption.

Fuel Oils. The increase of 5.0 percent in residual fuel demand, forecast for 1955, indicates only a partial recovery from the sharp decline of 6.8 percent in 1954.

The gain of 7.1 percent in distillate fuel oil demand, compared with an increase of 7.8 percent in 1954, includes some recovery in industrial demand and a substantial increment in heating oil requirements. The higher percent gain in 1954 was due to comparison with abnormal mild weather in 1953, whereas the weather in 1954 was about normal, except for a mild February.

The decline of 3.2 percent in kerosine demand in 1955 is based on a continuing substitution of Number 1 distillate for certain former uses of kerosine.

The forecast of a gain of 12.3 percent in the domestic demand for other products includes gains of 36 percent for jet fuel, 13 percent for liquefied gases and coke, 9 percent for lubricants, and about 7 percent for asphalt and still gas.

Stocks Above Needs. Stocks of crude oil declined 16.1 million barrels in 1954. The indicated increase of 6 million barrels in 1955 represents actual changes through July. For subsequent months, the production of crude oil used is the same as the estimated demand.

The stocks of other oils—refined products and other light oils—increased about 49 million barrels in 1953 and have been in excess of normal requirements much of the time since then. The forecast of an increase of 13 million barrels in these stocks in 1955 is based primarily on current runs that apparently are in excess of requirements.

Revised Forecast, 1955, U. S. Supply and Demand, All Oils

Source: U. S. Bureau of Mines

(Millions of barrels except daily averages in thousands of barrels)

ITEM	ACTUAL 1954		1955 BY QUARTERS				FORECAST 1955 YEAR		% Diff. 1954-1955
	Year	Daily	Actual 1st Qtr.	Estimate 2nd Qtr.	Forecast 3rd Qtr.	Forecast 4th Qtr.	Year	Daily	
Production	**2,565.0**	**7,027**	**681.1**	**674.9**	**677.0**	**686.0**	**2,719.0**	**7,449**	**+ 6.0**
Crude	2,316.3	6,346	614.5	612.5	612.0	618.0	2,457.0	6,731	+ 6.1
Other Oils	248.7	681	66.6	62.4	65.0	68.0	262.0	718	+ 5.4
Imports	**383.9**	**1,052**	**121.3**	**102.7**	**100.0**	**112.0**	**436.0**	**1,195**	**+ 13.6**
Crude	239.5	656	66.9	66.1	69.0	69.0	271.0	743	+ 13.2
Refined	144.4	396	54.4	36.6	31.0	43.0	165.0	452	+ 14.3
New Supply	**2,948.9**	**8,079**	**802.4**	**777.6**	**777.0**	**798.0**	**3,155.0**	**8,644**	**+ 7.0**
Change Stocks	**—10.6**	**—29**	**—28.5**	**+40.5**	**+38.0**	**—31.0**	**+19.0**	**+52**	.....
Crude	—16.1	—44	+6.0	+6.0	—6.0	.....	+6.0	+16	.....
Products	5.5	+15	—34.5	+34.5	+44.0	—31.0	+13.0	+36	.....
Total Demand	**2,959.5**	**8,108**	**830.9**	**737.1**	**739.0**	**829.0**	**3,136.0**	**8,592**	**+ 6.0**
Gasoline	1,272.8	3,487	297.8	353.2	358.0	333.0	1,342.0	3,677	+ 5.4
Residual	549.0	1,504	168.1	134.4	123.5	151.0	577.0	1,581	+ 5.1
Distillate	550.6	1,508	205.4	105.1	98.5	176.0	585.0	1,603	+ 6.2
Kerosine	123.2	338	43.8	15.1	17.6	41.5	118.0	323	— 4.2
All Other	463.9	1,271	115.8	129.3	141.4	127.5	514.0	1,408	+ 10.8
Exports	**130.0**	**356**	**30.6**	**33.4**	**30.5**	**28.5**	**123.0**	**337**	**— 5.4**
Crude	13.6	37	2.1	3.6	3.3	3.0	12.0	33	— 11.6
Refined	116.4	319	28.5	29.8	27.2	25.5	111.0	304	— 4.7
Domestic Demand	**2,829.4**	**7,752**	**800.3**	**703.7**	**708.5**	**800.5**	**3,013.0**	**8,255**	**+ 6.5**
Gasoline	1,238.3	3,393	290.5	344.5	350.0	325.0	1,310.0	3,589	+ 5.8
Residual	522.1	1,430	158.7	126.1	117.2	146.0	548.0	1,501	+ 5.0
Distillate	526.4	1,442	200.6	99.4	93.0	171.0	564.0	1,545	+ 7.1
Kerosine	118.3	324	43.0	14.2	16.8	40.5	114.5	314	— 3.2
All Other	424.3	1,163	107.5	119.5	131.5	118.0	476.5	1,306	+ 12.3
Daily Averages (Thousands of Barrels)									
Total Production	7,027	7,027	7,567	7,417	7,359	7,457	7,449	7,449	+ 6.0
Imports	1,052	1,052	1,348	1,128	1,087	1,217	1,195	1,195	+ 13.6
Change in Stocks	—29	—29	—317	445	413	—337	52	52	.....
Total Demand	8,108	8,108	9,232	8,100	8,033	9,011	8,592	8,592	+ 6.0
Exports	356	356	340	367	332	310	337	337	— 5.4
Domestic Demand	7,752	7,752	8,892	7,733	7,701	8,701	8,255	8,255	+ 6.5
Runs to Stills	6,958	6,958	7,430	7,302	7,378	7,380	7,373	7,373	+ 6.0
Demand Domestic Crude	6,391	6,391	6,762	6,661	6,720	6,717	6,715	6,715	+ 5.1

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EMSCO B-127 Masts give you a money-saving combination of maximum portability and faster, easier assembly.

Mast and substructure of the B Series Masts are designed as a unit to permit ground level assembly. This reduces rig-up time, provides safer working conditions, and allows the use of smaller gin pole trucks in assembly.

The B Series Mast is a sound, rigid structure with a minimum of internal bracing. Four-legged construction permits safe, continuous and positive line control during erection. The erection gin pole is separate and carries none of the working load.

Rear legs of the mast are pinned into their pedestals on top of the substructure and the front legs are cradled within. Pivoting on its rear legs, the mast is raised from ground level in a smooth, continuous operation, utilizing only the power of the hoist.

The mast can be transported in one piece on auxiliary wheels or tracks or nested into sections of roadable widths. Barge installations are ideal since the mast does not have to be snubbed into place on being raised, or pulled off center on being lowered.

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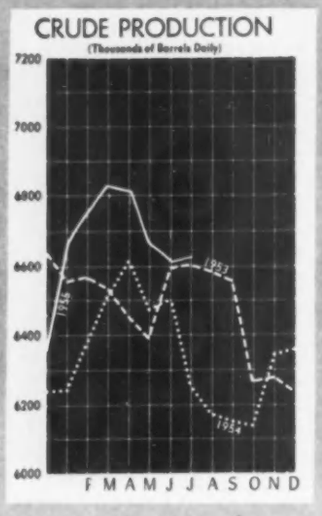
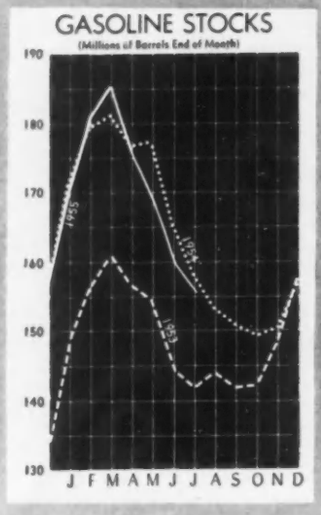
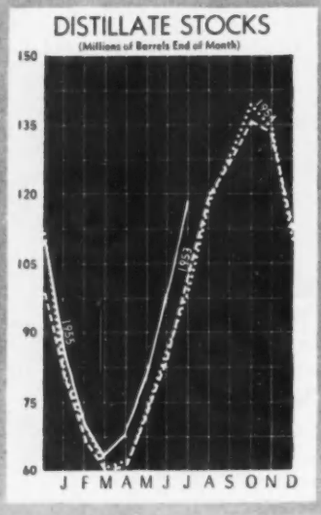
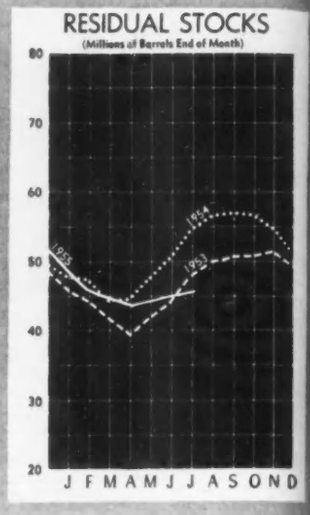
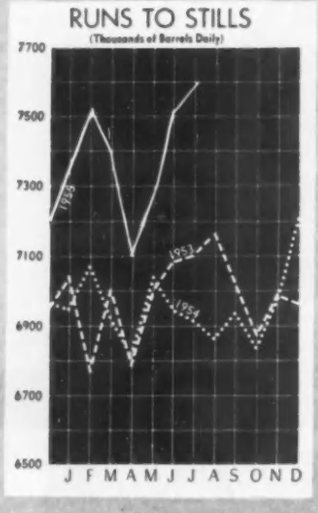
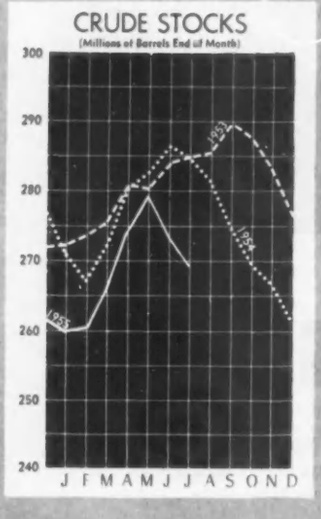












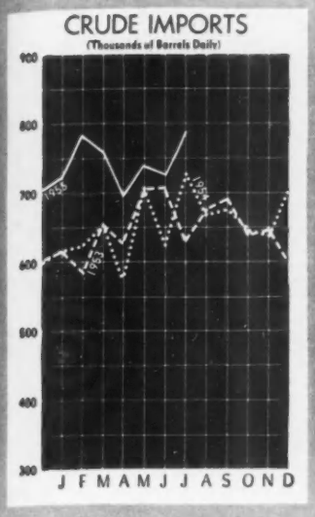
Petroleum Trends in U. S. . . .

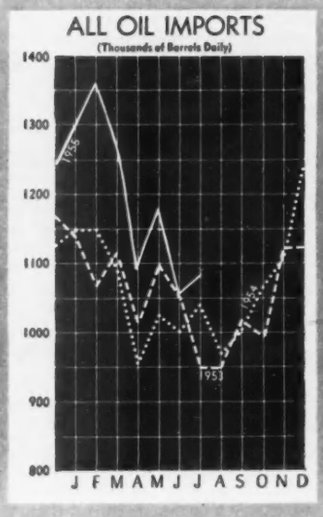
By CECIL W. SMITH, WORLD OIL Staff

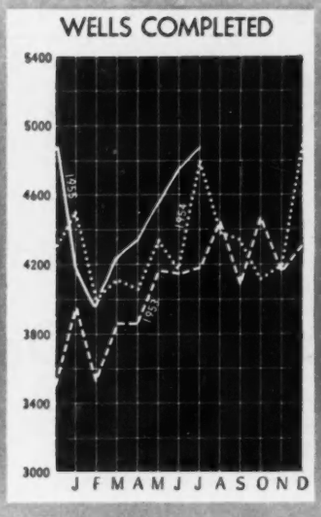
U. S. Crude Production by States
(THOUSANDS OF BARRELS)

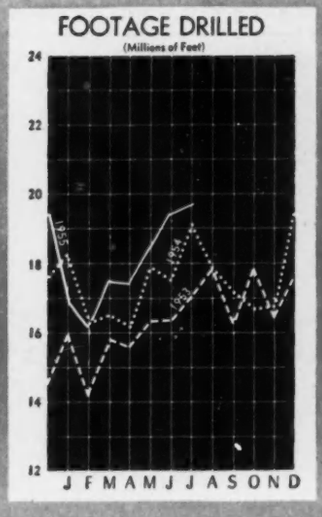
STATE or DISTRICT	DAILY AVERAGE PRODUCTION July, 1955	June, 1955	July, 1954	% Diff. July, '55-'54	TOTAL PRODUCTION First Seven Months 1955	1954	% Diff. '55-'54
Alabama	3.5	3.6	4.3	— 18.6	759	946	— 19.8
Arkansas	74.4	75.2	85.3	— 12.8	16,478	17,372	— 5.2
California	973.3	969.3	968.8	+ 0.5	205,750	209,099	— 1.6
Colorado	147.1	142.2	117.9	+ 24.8	27,898	22,902	+ 21.8
Florida	1.4	1.4	1.5	— 6.7	278	324	— 14.2
Illinois	234.4	232.2	178.9	+ 31.0	47,023	37,826	+ 24.3
Indiana	29.8	29.6	29.0	+ 2.8	6,246	6,645	— 6.0
Kansas	322.5	312.1	332.4	— 3.0	69,862	69,796	+ 0.1
Kentucky	41.0	40.3	37.0	+ 10.8	8,467	7,890	+ 7.3
Louisiana	712.8	691.2	659.9	+ 8.0	151,664	148,249	+ 2.3
North Louisiana	117.7	116.4	109.6	+ 7.4	25,010	24,328	+ 2.8
South Louisiana	595.1	574.8	550.3	+ 8.1	126,654	123,921	+ 2.2
Michigan	31.4	31.1	32.3	— 2.8	6,673	7,072	— 5.7
Mississippi	100.1	98.2	91.4	+ 9.5	20,484	19,703	+ 4.0
Missouri	0.2	0.2	0.2	.....	43	49	— 12.3
Montana	45.6	46.5	41.1	+ 10.9	9,415	7,510	+ 25.4
Nebraska	29.0	29.4	20.2	+ 43.6	5,307	4,144	+ 28.1
Nevada	0.2	0.2	.....	.....	41	.....	.....
New Mexico	225.8	223.5	207.4	+ 8.9	47,113	42,999	+ 9.6
Southeast New Mexico	224.2	221.9	205.2	+ 9.3	46,582	42,564	+ 9.4
Northwest New Mexico	1.6	1.6	2.2	— 27.3	531	435	+ 22.1
New York	11.0	11.1	8.6	+ 27.9	1,890	1,913	— 1.2
North Dakota	37.3	28.8	14.2	+162.7	6,074	3,051	+ 99.1
Ohio	11.1	11.2	9.7	+ 14.4	2,366	2,267	+ 4.4
Oklahoma	550.2	542.8	471.8	+ 16.6	116,010	111,749	+ 3.8
Pennsylvania	21.4	22.0	24.8	— 13.7	4,707	5,542	— 15.1
South Dakota	0.1	0.1	0.1	.....	21	15	+ 40.0
Tennessee	.....	0.1	.....	.....	8	10	— 20.0
Texas	2,721.3	2,776.6	2,636.4	+ 3.2	616,675	577,942	+ 6.7
Dist. 1—South Central	48.6	53.5	41.5	+ 17.1	10,852	8,895	+ 22.0
Dist. 2—Middle Gulf	139.3	143.7	136.9	+ 1.8	32,180	31,047	+ 3.6
Dist. 3—Upper Gulf	439.3	442.8	438.5	+ 0.2	97,540	94,590	+ 3.1
Dist. 4—Lower Gulf-S.W.	227.8	235.6	238.3	— 4.4	52,350	53,064	— 1.4
Dist. 5—East Central	47.4	45.8	43.0	+ 10.2	10,167	9,522	+ 6.8
Dist. 6—Northeast	321.0	328.0	331.7	— 3.2	74,185	74,428	— 0.3
Dist. 7-B—North Central	139.8	140.9	119.2	+ 17.3	29,831	26,626	+ 12.0
Dist. 7-C—West Central	174.2	184.4	178.1	— 2.2	39,794	38,640	+ 3.0
Dist. 8—West	902.2	908.2	838.8	+ 7.6	199,866	182,891	+ 9.3
Dist. 9—North	191.8	205.1	178.9	+ 7.2	42,131	39,909	+ 5.6
Dist. 10—Panhandle	89.9	88.6	82.0	+ 9.6	18,536	17,362	+ 6.8
Utah	5.8	5.6	5.2	+ 11.5	1,186	1,120	+ 5.9
Virginia	0.1	0.1	.....	.....	11	5	+120.0
West Virginia	6.8	7.4	7.8	— 12.8	1,409	1,721	— 18.1
Wyoming	285.6	284.1	273.1	+ 4.6	57,977	53,967	+ 7.4
Total United States	6,623.2	6,616.1	6,259.3	+ 5.8	1,431,835	1,361,828	+ 5.1

Source: Bureau of Mines and API. Texas districts data from API and do not necessarily agree with state totals.









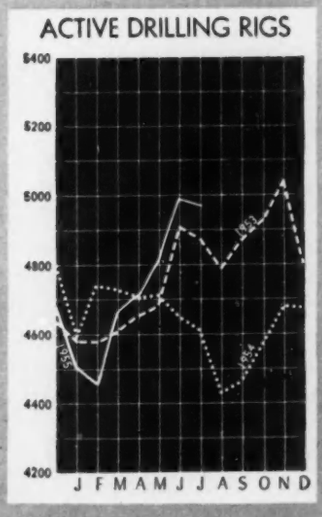
- **Drilling pushed to new high mark**
- **Crude imports highest this year**
- **Refinery runs at all-time peak**

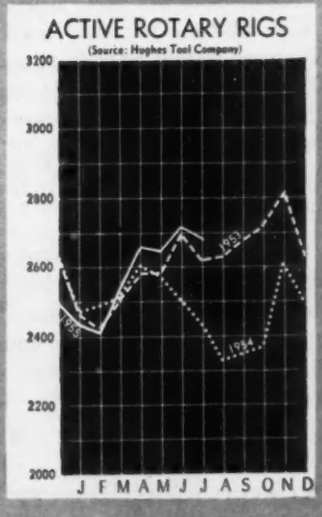
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1953:											
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July	6,242	6,916	284,894	3,480	158,010	1,416	101,657	1,089	54,365	724	1,038
August	6,168	6,862	281,043	3,492	153,168	1,453	117,579	1,069	56,322	664	966
September	6,151	6,939	274,608	3,511	150,916	1,514	128,061	1,086	56,702	672	999
October	6,135	6,834	269,442	3,457	149,661	1,545	139,128	1,066	56,541	642	1,065
November	6,346	6,975	264,566	3,530	150,604	1,622	133,886	1,120	54,891	636	1,104
December	6,394	7,238	258,385	3,605	155,400	1,668	108,144	1,187	52,105	729	1,301
1955:											
January	6,761	7,379	260,156	3,639	169,562	1,740	86,692	1,235	49,457	739	1,348
February	6,835	7,549	258,630	3,655	181,643	1,847	68,513	1,239	46,042	751	1,379
March	6,886	7,374	264,430	3,543	183,972	1,703	62,457	1,185	44,970	742	1,319
April	6,887	7,136	275,232	3,502	175,601	1,534	70,139	1,110	43,838	697	1,123
May	6,677	7,268	276,948	3,595	168,751	1,519	83,559	1,111	45,083	742	1,137
June	6,616	7,508	273,338	3,670	160,305	1,640	99,461	1,124	44,911	742	1,063
July	6,623	7,599	269,642	3,732	156,627	1,590	118,367	1,114	45,325	789	1,085
July, 1955 Change:											
In Month	+7	+91	−3,696	+62	−3,678	−50	+18,906	−10	+414	+47	+22
In Year	+381	+683	−15,252	+252	−1,383	+174	+16,710	+25	−9,040	+65	+47
Week Ended:											
8-12-55	6,635	7,647	264,517	3,792	154,983	1,623	122,214	1,141	45,705	781	1,102
8-13-54	6,158	6,735	279,824	3,364	156,328	1,438	107,753	1,085	55,673	711	917

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Distillate Stocks Near Dangerous Level

TOO MUCH DISTILLATE fuel oil is being manufactured by U. S. refiners. Stocks of this product continued to increase sharply during the past month. If permitted to continue growing at recent rates, distillate inventories will reach excessive quantities before enlarged winter demand begins in November.

Thus it became increasingly evident during the past month that crude runs to U. S. refinery stills need to be reduced sharply from their near record-breaking levels.

High consumption was still keeping gasoline supplies below year ago volumes, despite record output. However, demand for gasoline will soon start its seasonal decrease, indicating continued high refining levels might result in a drastic change in the motor fuel picture.

Meanwhile, crude oil stocks continued to decline as a result of high refinery operations and reduced crude production. Crude oil supplies are in good condition, and curtailed refinery runs would not have any serious affect on them.

Consequently, everything pointed to the need for smaller U. S. crude runs to refinery stills.

•

HIGH REFINERY RUNS are responsible for the increase in distillate fuel supplies. During July runs reached a new all-time monthly high of 7,599,000 barrels daily. This was 90,000 barrels per day more than in June, and 50,000 barrels per day larger than the former peak of 7,549,000 barrels in February of this year.

The first two weeks of August found refinery runs continuing just slightly below the record established during July.

Consequently, large quantities of distillate fuel oil have been made, although yields were adjusted to manufacture more gasoline and less heating oil. It is doubtful if refiners can adjust yields much farther. The only other thing to do is to curtail over-all refinery crude runs.

•

EXCESSIVE DISTILLATE SUPPLIES are a real possibility unless crude runs are curtailed at once.

Stocks of distillate had reached a seasonal high of 122¼ million barrels by August 12. They did not hit this level until mid-September during 1954. Inventories will continue increasing until November, when colder weather will begin to boost demand for this product.

At their current level distillate inventories were 14⅔ million barrels greater than at the corresponding period a year ago, and just 17 million barrels short of a new all-time high. Since the end of March, 60 million barrels have been added to distillate inventories. During the like period of 1954, additions totaled 47 million barrels.

It is desirable that not more than 20 million, or possibly 25 million barrels at the most, be added to stocks during the next 2½ months. This would result in distillate stocks of 142 million to 147 million barrels by November 1, compared with 139 million barrels in 1954.

To keep inventories of distillate within this range, additions cannot average more than 250,000 to 300,000 barrels per day between now and the end of October. Since the first of June additions have averaged 543,700 barrels per day. Hence a sizeable reduction in distillate fuel oil production will be necessary if these stocks are not to become excessive.

•

OTHER CONDITIONS of the U. S. petroleum industry are in a favorable position. High demand has kept record output of gasoline from creating excessive quantities. Motor fuel stocks on August 12 totaled 155 million barrels, 1⅓ million barrels less than a year ago. They need to be reduced by only 100,000 barrels daily between mid-August and the end of September to be in good shape for coming winter months. While this should be achieved with ease, refiners need to watch the gasoline situation closely after the end of September.

Demand will begin tapering off, and high yields could cause additions to begin too early. If inventories are down to 150 million barrels by the end of September, they should be held close to this quantity through November.

Crude oil stocks also are in good condition. In totaling 264½ million barrels on August 13, they were 15 million barrels less than at the end of May.

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U. S. Wells Completed in July and First Seven Months, 1955-1954

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR JULY: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	TOTAL NEW WELLS: July, 1955	June, 1955	July, 1954	Total Footage July, 1955	DETAILS FOR JANUARY-JULY: NEW WELLS: 1955	1954	Percent Diff.	FOOTAGE: 1955	1954	Rigs in Operation: July 31, 1955	June 30, 1955	July 31, 1954
Alabama				2				2	1	5	8,509	30	48	— 37.5	127,814	250,263	3	5	4
Arizona												4	8	— 50.0	16,136	30,774	1	1	4
Arkansas	55		1	25			1	82	49	46	236,828	413	315	+ 31.1	1,316,632	1,130,917	71	63	35
California	139		4	42				185	207	177	894,123	1,400	1,451	— 3.5	6,825,339	6,652,703	236	233	201
Colorado	25		6	112				143	135	112	742,051	859	742	+ 15.8	4,599,334	4,104,646	103	96	62
Florida				3				3	3	4	23,888	20	19	+ 5.3	130,552	121,835	5	6	4
Georgia										4			7	—100.0		18,008	1		
Idaho			1					1			4,032	3			11,337			1	
Illinois	248		3	175				426	361	268	1,050,372	2,126	1,696	+ 25.4	5,165,304	4,169,285	333	345	265
Indiana	10			35				45	72	81	75,240	336	471	— 28.7	515,070	717,166	98	93	126
Kansas	197		27	191			6	421	406	421	1,521,705	2,701	2,449	+ 10.3	9,851,302	8,589,904	458	462	411
Kentucky	66		19	87				172	147	123	255,176	889	795	+ 11.8	1,439,746	1,501,105	137	123	85
Louisiana	182	20	21	107			1	331	356	289	2,242,087	2,350	1,974	+ 19.0	14,933,783	12,532,510	364	384	276
North Louisiana	107	5	9	45				166	167	154	531,009	1,209	1,017	+ 18.9	3,572,565	2,980,774	78	90	57
South Louisiana	75	15	12	62			1	165	189	135	1,711,078	1,141	957	+ 19.2	11,361,218	9,551,736	288	294	219
*Gulf of Mexico	9	1	4	8				22	32	18	218,062	177	124	+ 42.7	1,652,941	1,135,980	40	47	28
Maryland																	3	7	4
Michigan	14		1	21				36	47	38	103,271	286	318	— 10.1	845,523	834,924	93	101	101
Mississippi	18	2		15				35	43	33	279,798	278	226	+ 23.0	2,092,529	1,605,014	35	37	28
Missouri									4	2		24	8	+200.0	13,095	9,095	3	4	
Montana	12			17				29	23	12	130,214	167	194	— 13.9	841,902	754,301	55	52	44
Nebraska	27			55				82	80	33	482,593	445	216	+106.0	2,566,369	1,205,347	54	58	31
Nevada									1			6	8	— 25.0	44,828	40,095	1	1	2
New Mexico	88		58	26				172	165	152	733,192	983	695	+ 41.4	4,184,690	3,776,365	158	160	115
New York	17				12			29	28	50	40,265	192	365	— 47.4	265,520	540,858	49	42	71
North Dakota	14			7				21	19	33	151,242	136	156	— 12.8	991,470	1,084,825	25	24	34
Ohio	63		28	19				110	96	108	227,849	643	622	+ 3.4	1,350,268	1,208,378	212	206	209
Oklahoma	446	7	40	204	6		3	706	658	842	2,506,557	4,313	4,876	— 11.6	14,774,742	16,537,518	634	664	748
Oregon									1			1			7,101			2	
Pennsylvania	21		17	5	17	5		65	59	66	119,829	417	636	— 34.4	792,062	1,121,314	120	112	161
South Dakota									2	1		6	15	— 60.0	35,579	86,712	3		1
Texas	932	35	36	638	5		1	1,647	1,710	1,701	7,183,287	11,107	10,618	+ 4.6	48,737,468	48,136,334	1,383	1,393	1,301
Dist. 1: South Central	91		2	51				144	156	118	354,392	1,024	623	+ 64.4	2,690,524	2,118,629	50	49	43
Dist. 2: Middle Gulf	18	2	3	41				64	62	66	375,498	458	474	— 3.4	2,741,893	2,836,894	49	44	45
Dist. 3: Upper Gulf	66	10	9	78				163	155	168	1,044,633	1,037	1,023	+ 1.4	6,655,422	6,961,832	136	127	123
*Gulf of Mexico		1						1			10,653	8			81,201		3	3	
Dist. 4: Lower Gulf-S.W.	45	9	8	38				100	133	135	540,778	790	875	— 9.7	4,156,637	4,513,675	87	95	80
*Gulf of Mexico				1				1		1	13,444	8	1	+700.0	77,187	9,980	2	3	3
Dist. 5: East Central	3			18				21	17	25	69,293	158	162	— 2.5	623,903	595,490	14	18	14
Dist. 6: Northeast	34	8	1	27				70	77	59	389,430	402	419	— 4.1	2,201,193	2,486,223	65	66	53
Dist. 7-B: North Central	146			152				298	244	333	1,027,257	1,782	1,635	+ 9.0	5,607,269	5,317,650	160	168	123
Dist. 7-C: West Central	52		1	36				89	92	97	504,196	702	752	— 6.7	3,830,796	3,872,015	127	130	126
Dist. 8: West	216	1		52	1		1	271	343	249	1,510,007	2,084	1,688	+ 23.8	11,337,002	10,087,436	391	392	344
Dist. 9: North	226	1	3	137	3			370	358	384	1,147,540	2,112	2,410	— 12.4	6,925,721	7,480,499	228	230	266
Dist. 10: Panhandle	35	4	9	8	1			57	73	67	220,263	558	562	— 0.7	1,967,208	1,865,991	76	74	84
Utah	2		2	6				10	10	6	40,661	58	30	+ 93.3	275,264	144,927	23	25	22
Washington																			1
West Virginia	15		40	6				61	52	57	152,624	349	303	+ 15.2	920,169	872,472	190	187	172
Wyoming	35		2	36				73	49	80	340,469	414	723	— 42.7	2,046,550	3,822,823	114	110	98
Total United States	2,626	64	306	1,834	40	5	12	4,887	4,784	4,744	19,545,862	30,956	29,984	+ 3.2	125,707,478	121,600,418	4,965	4,997	4,616
Total Western Canada	200		7	76			1	284	198	223	1,102,500	1,369	1,128	+ 21.4	5,803,596	4,519,162	209	183	176

* Gulf of Mexico wells are included in their respective district totals.

Drilling Hits Peak Level

Last year's mark being led by 3.2 percent.

MORE WELLS were completed during July than in any month in history. This peak performance of the nation's drillers boosted the year's wells to a 3.2 percent over last year's seven-months total, which at that time had been a record.

July's completed wells added to 4887, a gain of 103 over the previous month's, and 143 more than were recorded in July of last year. The month's footage was also at a new peak. A total of 19,545,862 feet was the aggregate depth of all wells completed during the month. Only twice before had a single month's footage amounted to 19 million feet.

In seven months, 30,956 wells were completed in the U. S. to give the current drilling program a 972-well, or 3.2 percent lead over 1954 operations. The large number of rigs now working may be expected to broaden this margin of difference and give the year substantially more completed wells than ever before.

This year, a total of 125,707,478 feet has been drilled, and that represents a gain of 3.4 percent over aggregate hole drilled in last year's comparable period. Current wells were a little deeper on the average than last year's, accounting for the slightly greater percentage increase in footage than occurred in wells. Average depth this year has been 4061 feet against last year's 4056.

A remarkable closeness between the two periods' drilling success existed. Through July, a total of 19,485 producing wells were completed, compared with 18,867 a year earlier, but both sums amounted to 62.9 percent of their respective total wells. However, some variance existed among the types of producers. Oilers this year totaled 17,210, for 55.6 percent of the total drilled, while a slightly smaller 55.2 percent was completed last year. New gas producers, totaling 1803, amounted to 5.8 percent, and a year earlier gassers had accounted for 6.4 percent.

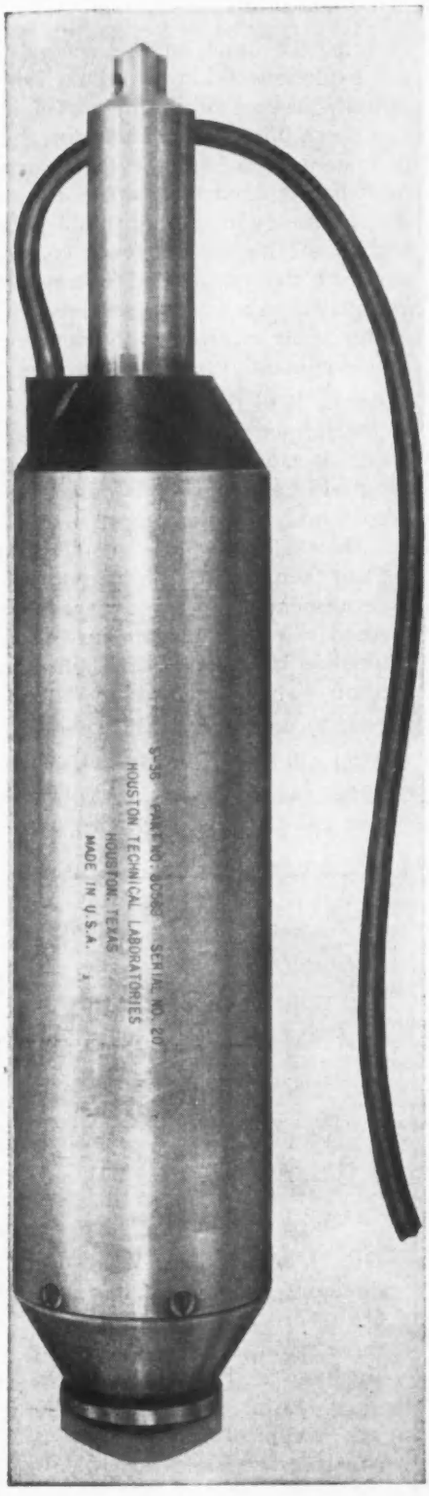


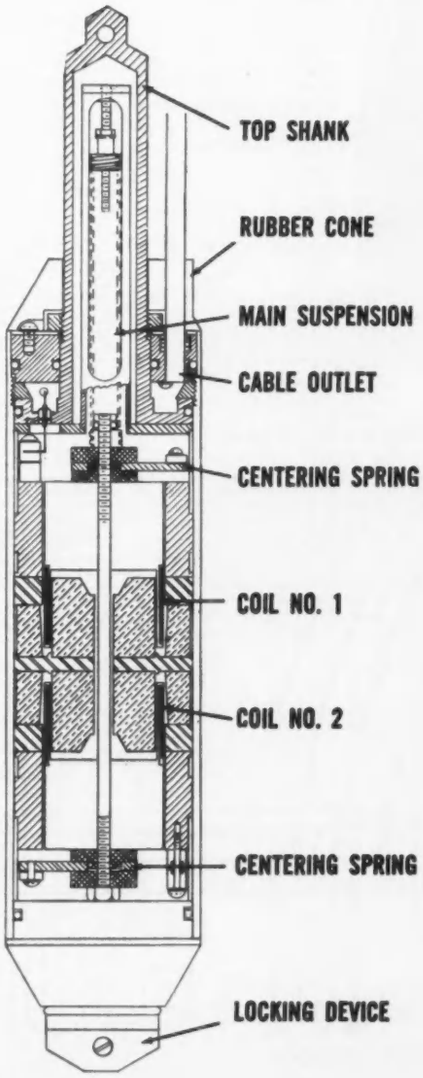
FIGURE 1—The S-36 detector has close frequency tolerance that results in excellent phase matching qualities even at 2 cps. Right is cross-section of detector.

SUITABLE FOR PORTABLE USE

VLF Refraction Method With Less Explosives Gives Excellent Results

Very low frequency (VLF) refraction seismographs can shoot long lines with modest charges. This means a response and sensitivity suitable for great spread lengths.

By J. A. F. GERRARD,
Director Geophysical Research,
Houston Technical Laboratories, Houston



LIMITATIONS of the reflection method of exploration are causing seismologists to turn again to the almost-forgotten refraction method. By eliminating some of the instrumental deficiencies connected with refraction surveys, they have developed what is called the "very low frequency" or VLF system.

And the VLF system is opening new possibilities in refraction shooting. Long lines can be shot without resorting to excessively large charges. The great explosions necessary in the past often made operators reluctant to use the method. But with VLF excellent results are being obtained with modest charges.

The refraction method is the oldest practical seismic exploration method, having been introduced by Mintrop in Germany in 1919. The first application in the U. S. was in 1923-24, which resulted in the discovery of several shallow salt domes on the Gulf Coast. This work was mainly "in line" refraction shooting.

In 1926 the introduction of "fan" shooting greatly extended the utility of the method, for it enabled large areas to be covered speedily and with sufficient accuracy for the detection of shallow salt domes.

An inherent limitation of the refraction method is the fact that shot-detector distances must be several

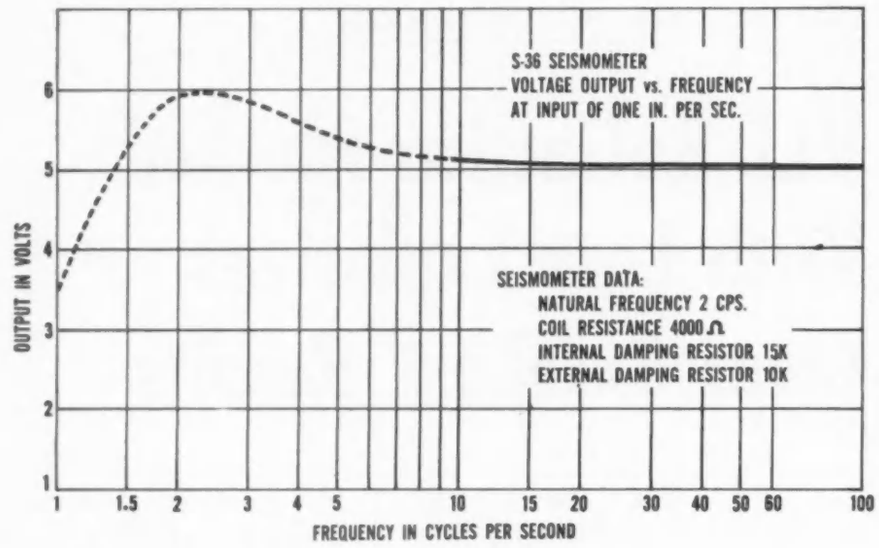


FIGURE 2—Response curve of detector.

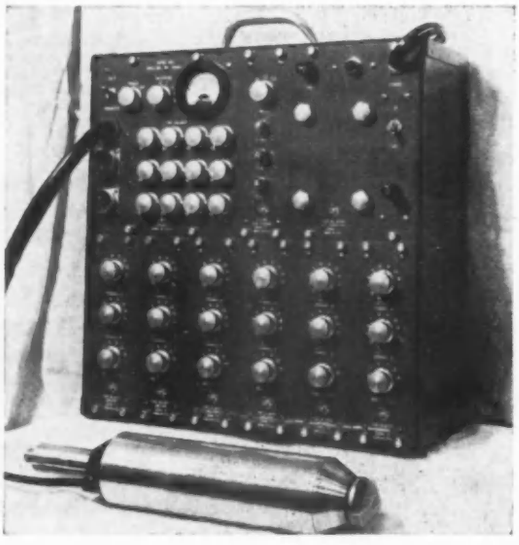
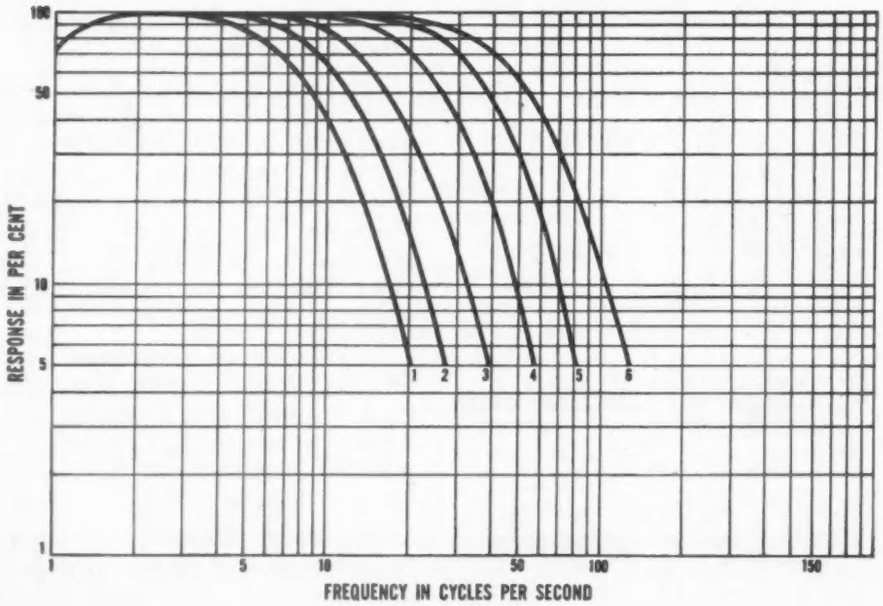


FIGURE 3—VLF system: 12 amplifiers, power supply, input unit, and one S-36 detector.

FIGURE 4—Frequency response curve of VLF amplifier.



times the depth penetrated, and as a consequence much of the energy of the explosion is lost travelling horizontally instead of in the useful up and down directions. This means that to map a deep bed, the seismologist must be prepared to dissipate a great deal of energy in the horizontal path, and as the higher frequency components of the propagated energy are attenuated much more severely, the energy being received at the detectors is predominantly "very low frequency."

About 1930 the natural limitations of the refraction method, as then applied, began to become apparent. Most of the shallow salt domes had been found, and the deeper ones did not show clearly. That geophysicists did not then persist with instrumental improvements to the refraction method was probably due to the introduction of the powerful reflection method, which seemed to be the answer to the seismologist's problem.

After 1930, when the refraction method was employed, it was usually

About the Author

DR. J. A. F. GERRARD, is director, geophysical research, Houston Technical Laboratories, Houston. He joined that company in 1952 as vice president. From 1951 to 1952 he was technical supervisor of Northwest Seismic Surveys. In the period 1950 to 1951 he was a geophysicist for Standard Oil Company of California. Dr. Gerrard received his B.S. degree in physics at London University in 1944 and also an A.R.C.S in physics at London University in 1944. He received his Ph.D. in geophysics at Cambridge University in 1950. He is the author of several published papers on geophysical subjects.

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Top shows a single refraction record taken with the VLF system . . .

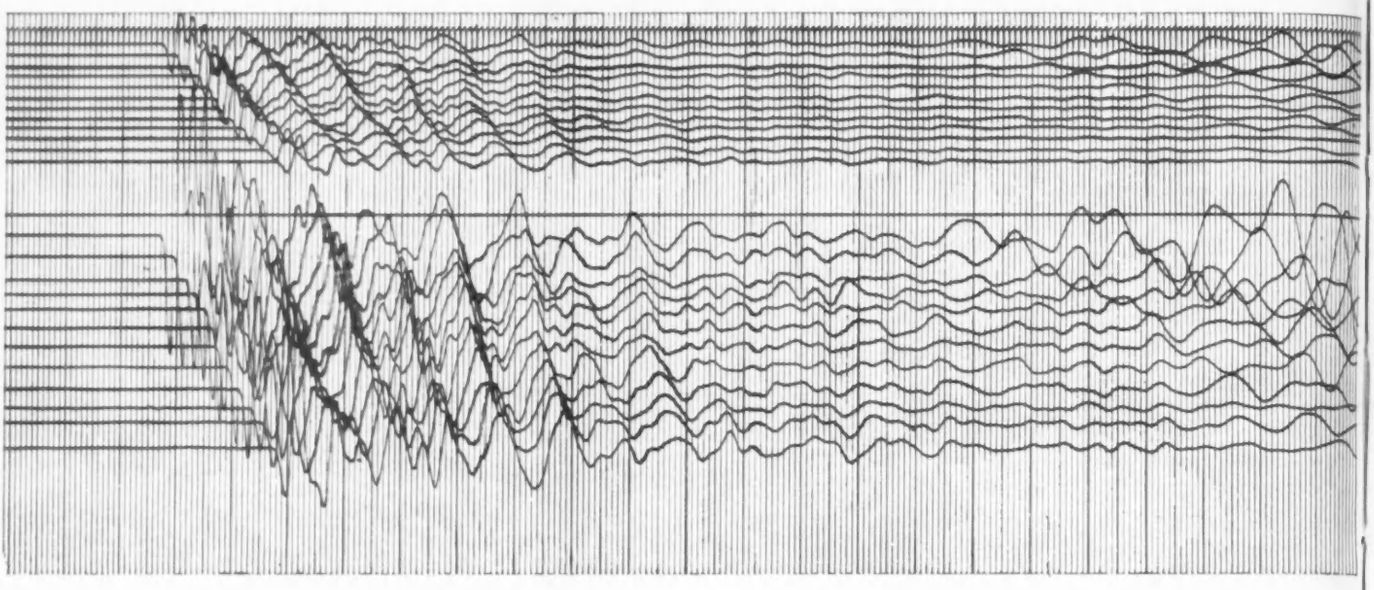


FIGURE 5

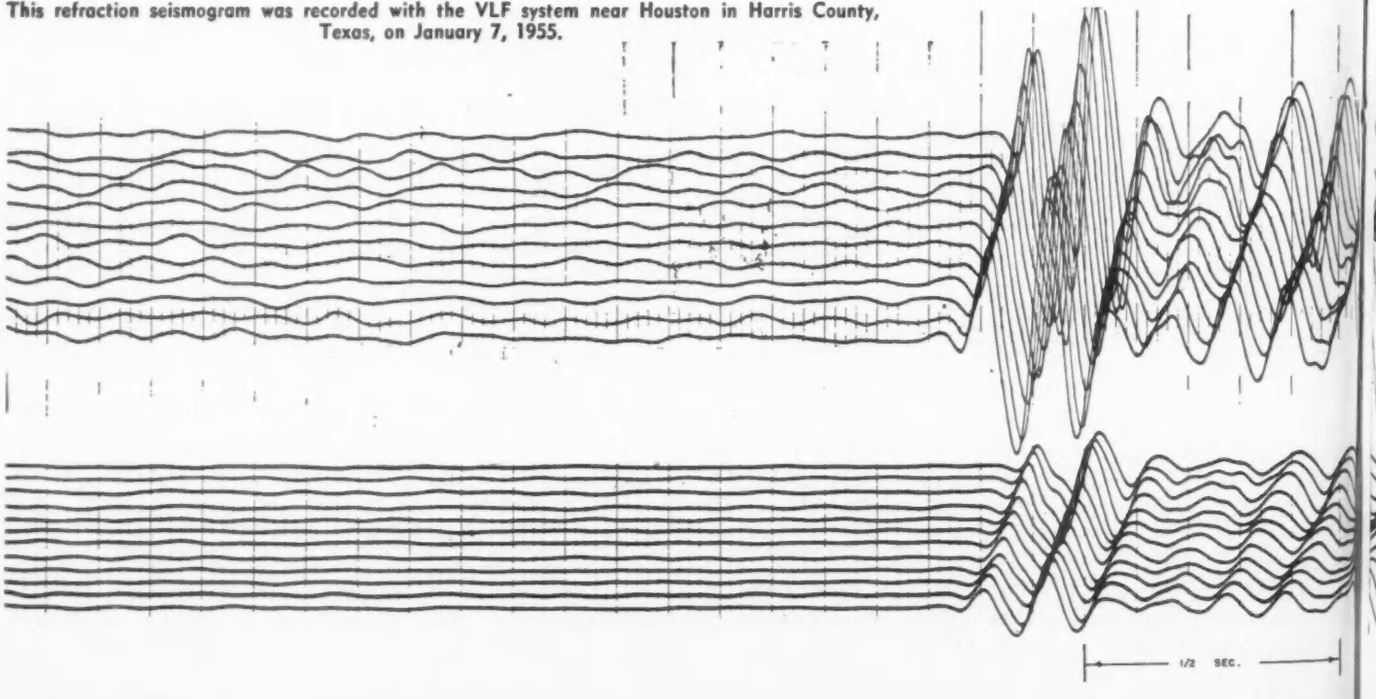
as an accessory to the reflection method and with tools designed for reflection exploration. Consequently, the results were very often disappointing.

The VLF has a low frequency response and sensitivity suitable for great spread lengths. Despite the extremely low natural frequency of the detectors, which results in a size considerably larger than that to which we have become accustomed in reflection surveys where "multiple" groups are used, no effort has been spared to make the VLF suitable for portable use in areas of difficult access and extreme climatic conditions. Twelve operating channels were considered optimum for this type of work. The long spreads involved would make the use of more channels an arduous task, whereas, fewer may result in an excesive number of charges being fired; very undesirable in some areas where portable drills may have to be employed.

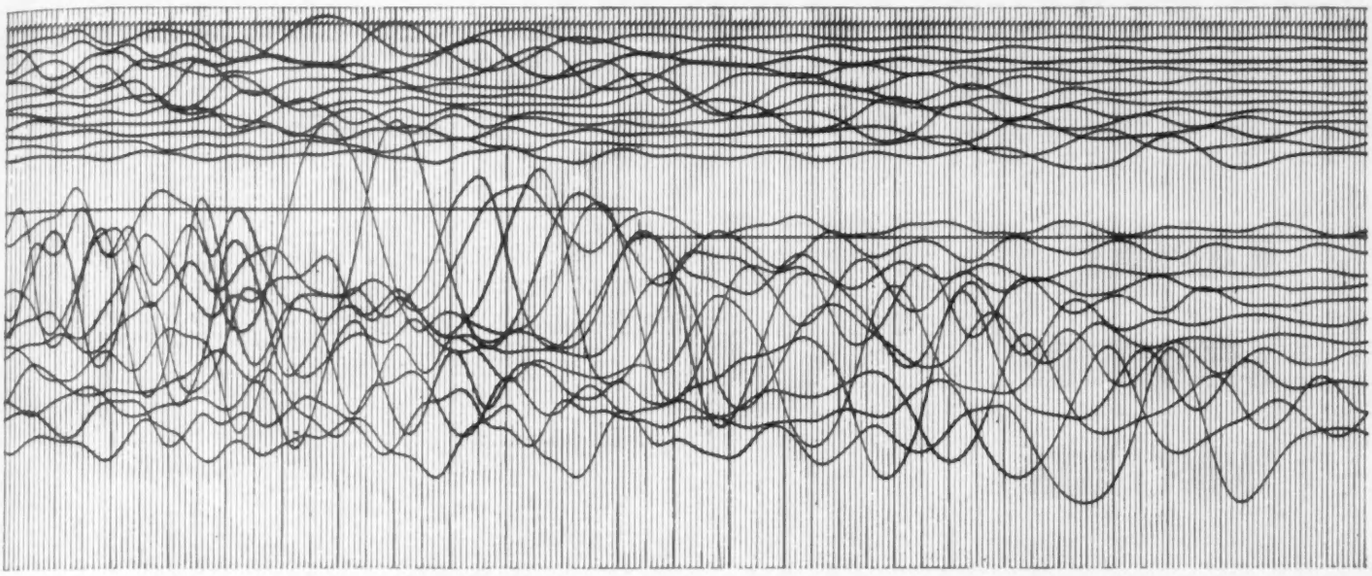
The detector (Figure 1) has a relatively large output (5 volts/inch/second), and its undamped resonant frequency is 2.00 ± .05 cycles/second. Such a close frequency tolerance results in excellent phase matching qualities even at 2 cps. As shown in the figure, double coil, hum bucking construction is employed to reduce the effect of external fields. The outer case is of the marsh type to facilitate planting in soft ground. However, except in the softest ground it has been normal to drill a small auger hole in which to set the detector. The response curve of the detector is shown in Figure 2.

The complete amplification system (input unit, 12 amplifiers and power supply) is shown in Figure 3. The amplifiers were designed for low frequency response and high gain. Fig-

This refraction seismogram was recorded with the VLF system near Houston in Harris County, Texas, on January 7, 1955.



. . . It is of interest because of the wealth of information it contains



ure 4 shows the frequency response characteristics of the amplifier, and it is seen that the response is flat to two cycles per second on the low side. In order to achieve this response, transformers were eliminated entirely from the circuit, and to reduce the high frequency disturbances from wind and man-made noises, the high cut filters shown in Figure 4 were built into the amplifier.

Because of the wide variations in the amplitudes of different refraction signals, two outputs, with an amplitude ratio of 4:1, were taken from each amplifier. Thus, when a big signal arrives at the detector, it may result in the high amplitude trace being deflected off the paper. The low amplitude trace, however, remains quite clear and may be picked with accuracy.

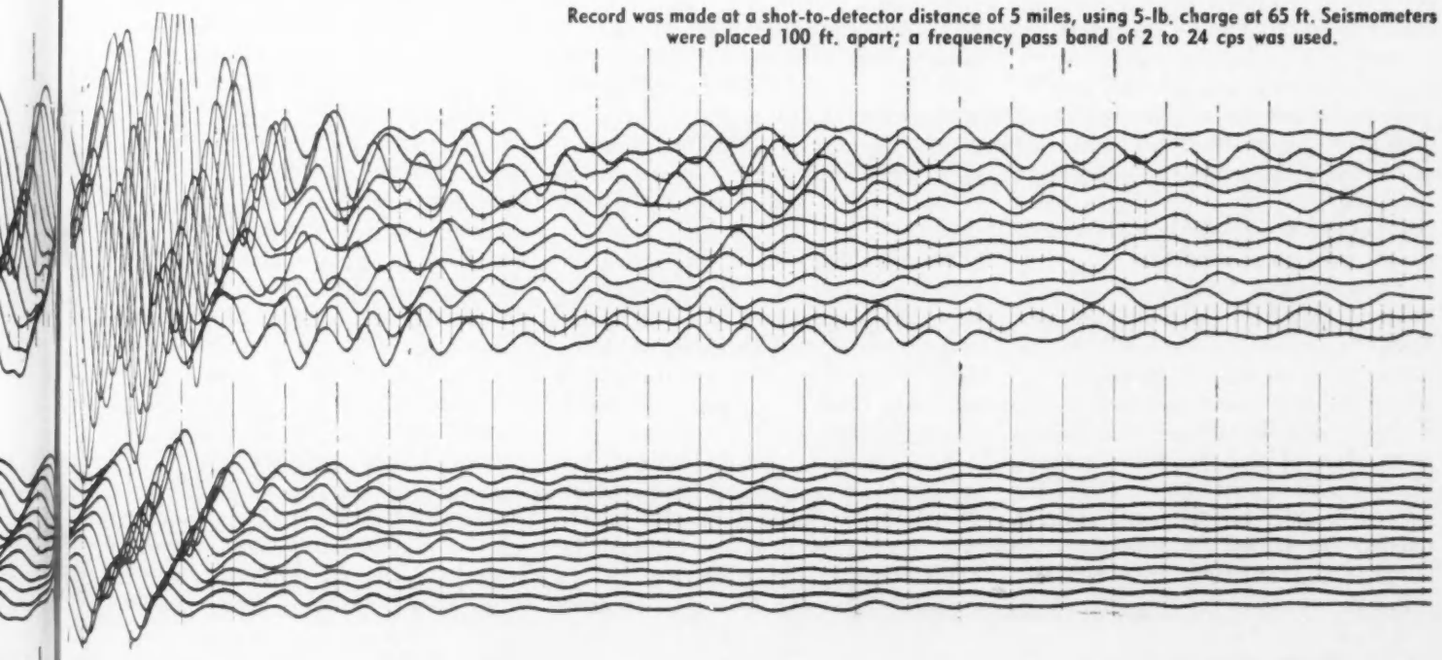
The camera is a conventional seismic recording oscillograph with eight-inch paper. Because of the lower frequencies involved, the paper speed is regulated at about 6½ inches per second, approximately half that used for reflection work.

Figure 5 shows a single refraction record taken with the VLF System. It is of interest because of the wealth of information it contains. The presence of the low frequency "long" waves indicates clearly the excellent low frequency response of the equipment.

Figure 6 shows another record taken in the Houston area. The small charges employed and the clear onset of the seismic event in VLF records are significant, for they make practicable the confident use of the refraction method in an area where the seismologist would normally hesitate because of the amount of explosive it would be necessary to employ to get satisfactory results. —**The End**

FIGURE 6

Record was made at a shot-to-detector distance of 5 miles, using 5-lb. charge at 65 ft. Seismometers were placed 100 ft. apart; a frequency pass band of 2 to 24 cps was used.



STONE CORRAL

KANSAS STRUCTURE INDICATOR

By DANIEL F. MERRIAM,
Geologist,
State Geological Survey of Kansas
Lawrence, Kansas

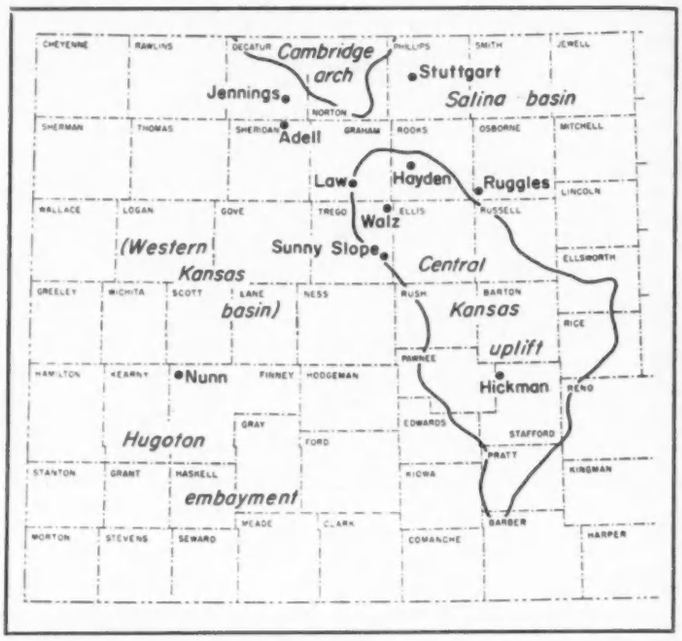


FIGURE 1—Oil fields discussed in this report and their relation to post-Mississippian structural elements of western Kansas.

THE STONE CORRAL formation of Permian age is proving a valuable indicator of Pennsylvanian structure in central and western Kansas. Structure maps on this formation reflect the Pennsylvanian structure with reasonable accuracy in 9 out of 10 oil fields which were studied. All the fields are relatively recent discoveries and are located in different structural provinces. Studies dating back to 1939 show there is a marked coincidence of structure on the Stone Corral and the Lansing.

The most common type of trap in western Kansas occurs beneath local anticlines. Exploration can be carried on by surface mapping, subsurface mapping, and geophysics or a combination of these methods depending on the geological conditions.

Over much of the area of western Kansas, generally speaking, surface mapping cannot be used reliably for determining structure at depth because the structural pattern of the Tertiary and Cretaceous rocks differs from that of the deeper Permian, Pennsylvanian, and older rocks. Consequently most of the exploration is carried on either by subsurface or geophysical methods in order to determine the structure of the older beds which lie below the surficial mantle of Cretaceous, Tertiary, and Quaternary strata (Merriam and Frye, 1954).

The Stone Corral formation of Permian age is the youngest formation that is both widely distributed and lithologically distinctive. It is, therefore, a good marker and is commonly used in structural work involving the pre-Cretaceous rocks of western Kansas. The Lansing group of Pennsylvanian age, which lies from 1000 to 2000 feet below the Stone Corral formation, is an important oil producing zone. Because the Stone Corral occurs at shallower depths than the Lansing, it can be used as a datum horizon for geophysical, mainly seismograph (Glover, 1953) and core-drill exploration.

It is the purpose of this article to demonstrate that the Stone Corral reflects the structure of the older beds and thus is a good indicator of structure of the Pennsylvanian rocks and especially the Lansing group at depth in western Kansas.

Maps have been prepared showing the structure on the top of the Stone Corral formation and on the top of the Lansing group in ten oil fields in central and western Kansas:

Adell (Sheridan County), Hayden (Rooks County), Hickman (Stafford County), Jennings (Decatur County), Law (Graham County), Nunn (Finney County), Ruggles (Osborne County), Stuttgart (Phillips County), Sunny Slope (Trego County), and Walt (Trego County).

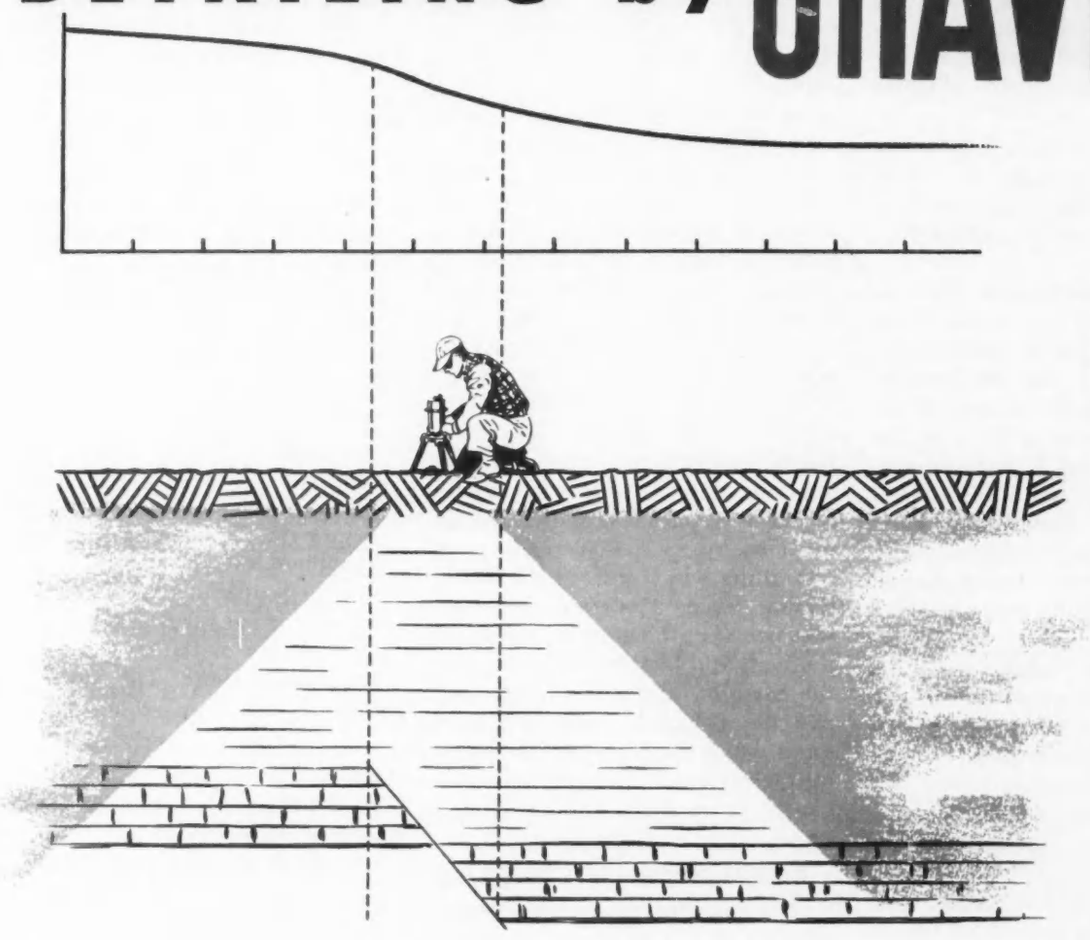
The location of these oil fields and their relation to major structural features of western Kansas are shown in Figure 1. All these fields except the Sunny Slope, which produces from Pennsylvanian Marmaton beds, produce from the Lansing-Kansas City sequence.

These fields were selected because (1) all produce from Pennsylvanian rocks; (2) they are located in different structural provinces—Hugoton embayment (western Kansas basin), central Kansas uplift, Cambridge arch, and Salina basin; (3) all are recent discoveries (Nunn, the oldest, was discovered in 1938) and considerable information, such as electric logs, is available; and (4) they are large enough to show the structure with considerable accuracy.

Information on the datum planes—the top of the Stone Corral and the top of the Lansing—was obtained from electric logs, drillers logs, and scout tops. Producing wells and dry

No. 4 of a Series

DETAILING by GRAVITY



The basic information obtained from an SSC Gravity Survey are maps of the gravity variations and a report on their significance to "oil finding."

The data on these maps is processed by the geophysicist so that the density variations thereon, are related to the geology of the area. In the report, their consequence to "oil finding" is interpreted by the geophysicist in co-operation with the geologist.

Detailed *gravity surveys* are recommended for these typical situations.

1. Where the area to be mapped does not justify the expense of a detailed seismic survey.
2. Where the seismograph is not effective, and
3. Where mappable density changes are directly related to geology such as:
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Deeper Pennsylvania structures in 9 out of 10 Western Kansas fields are revealed by structure maps

holes are shown on each map. In each field the structure contours on a 10-foot interval of both datums are superimposed for comparison (Figures 2-11).

(For a comprehensive discussion of the stratigraphy the reader is referred to: The Kansas Rock Column by R. C. Moore and others [1951].)

Regional considerations. The regional structure on top of the Stone Corral formation has a northerly dip of about five feet to the mile in western Kansas, except in the area of the Cambridge arch and in parts of Comanche, Barber, and Kingman counties, where it dips south. The Cambridge arch and western Kansas basin are revealed by the configuration of the contours, but the central Kansas uplift and the Salina basin are not recognized as such. The regional structure on top of the Lansing group has a southerly dip of about five feet to the mile into the Hugoton embayment. The Cambridge arch is also distinctly recognizable as well as the central Kansas uplift and Salina basin to a lesser degree. The north dip on the Stone Corral formation and the south dip on the Lansing group produce a convergence to the north of about ten feet to the mile. This convergence, although small, is important in considering the relationship of the structure on the Stone Corral formation and the Lansing group. This is especially true since the structural closure in most of the oil fields is small.

An explanation of some points concerning the structural development of western Kansas is probably in order. Whether or not a major or minor structural feature is revealed on a structure map is dependent on the time when that feature was developed. Thus, because the Cambridge arch continued to develop after the central Kansas uplift became quiescent, it is recognizable on the Stone Corral structure map whereas the central Kansas uplift is not. This also is the case for the Hugoton embayment which was partially obliterated and modified by the post-Permian northerly tilting which formed the western Kansas basin. However, this tilting was not steep enough to reverse the southerly dip of the older beds. Thus the Mesozoic strata dip to the north and the Paleozoic strata dip to the south which explains the convergence of the interval between the Stone Corral formation and the Lansing group.

COMPARISON OF STRUCTURE

The following discussion points out relation of the structure on the top of the Stone Corral formation to the structure on the top of the Lansing group in the ten central and western Kansas oil fields which were studied.

Adell field was discovered in 1944 and produces from the Lansing-Kansas City at a depth of 3755 feet in the discovery well and covers an area of 1200 acres.

Structurally, the field is situated on the Jennings anticline (Merriam and Atkinson, 1955) on the west flank of the Cambridge arch. Several other oil fields are also located along the crest of this anticline where local areas of closure occur. The dip on the west side of the anticline is steeper than on the east side and the structure plunges to the south and southeast.

The field (Figure 2) is on a closed anticline which trends northwest-southeast. Three separate areas of closure on the Lansing are revealed. Maximum over-all closure is 55 feet and the southeast end of the producing area is not yet defined, so that the total closure of the structure may be considerably more. The Stone Corral structure has a maximum closure of only 16 feet and there are two separate areas of closure. The structure on the Stone Corral and the Lansing is very similar, especially in areal extent and geographic position. However, the difference in magnitude is striking.

Hayden field was discovered in 1949 and produces from the Lansing-Kansas City and Arbuckle at depths

FIGURE 2—Stone Corral (dotted contours) and Lansing (solid contours), Adell oil field, Sheridan County.

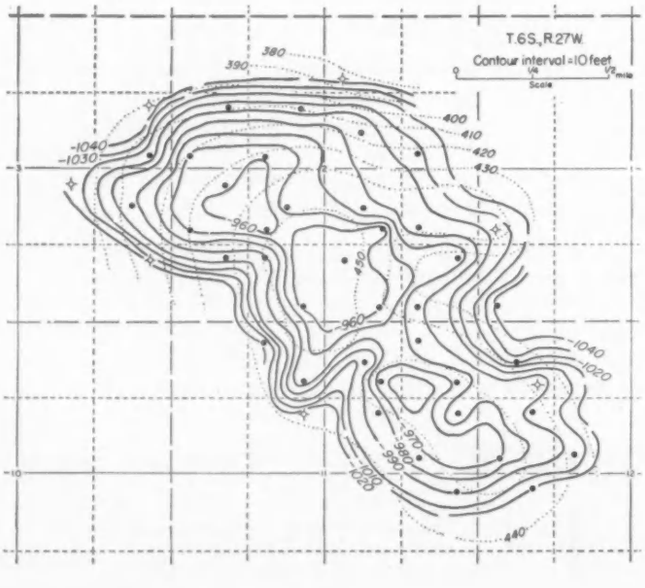
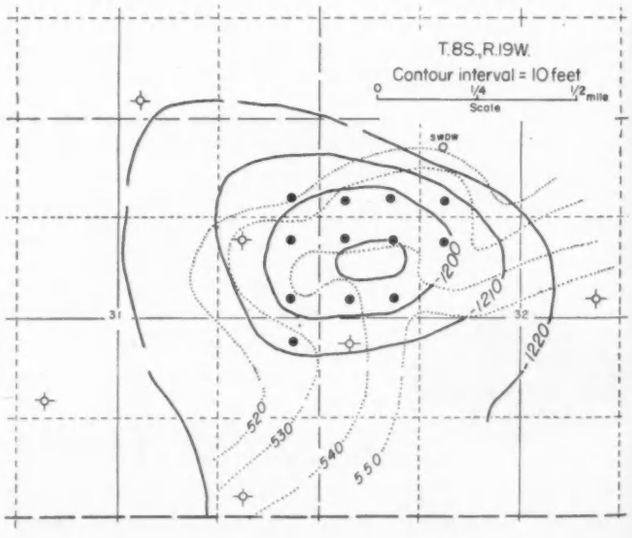


FIGURE 3—Stone Corral (dotted contours) and Lansing (solid contours), Hayden oil field, Rooks County.



of 3289 and 3513 feet, respectively, in the discovery well. It covers 360 acres.

Structurally, the field is situated on the northern end of the central Kansas uplift just south of a large broad synclinal area which separates the central Kansas uplift from the Cambridge arch (Lee and Merriam, 1954, pl. 1). The regional dip of the Stone Corral is north and the regional dip of the Lansing is slightly south.

Production is from a zone in the Lansing group on a slightly elongated closed anticline. The structure has a northwest-southeast trend and shows a closure of about 20 feet (Figure 3). The structure on the Stone Corral formation is an elongated northeast-southwest anticline that shows no closure with a ten-foot contour interval and that flares from a northwesterly plunging structural nose. A similar relation was shown by Landes and Keroher (1939, p. 43) in the Wakeeney field where the structure on the Stone Corral has the same pattern.

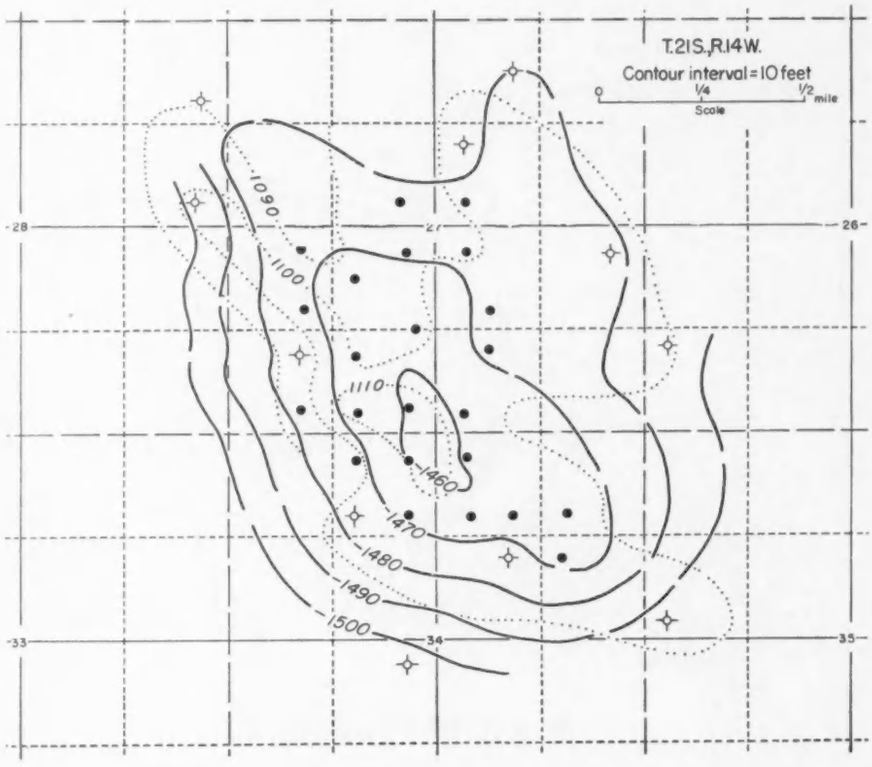


FIGURE 4—Stone Corral (dotted contours) and Lansing (solid contours), Hickman oil field, Stafford County.

Hickman field was discovered in 1951, produces from Lansing-Kansas City and Simpson from depths of 3522 and 3747 feet, respectively, in the discovery well, and covers 760 acres.

Structurally, the field is situated near the western margin of the central Kansas uplift. The regional dip on the Stone Corral formation is to the north (Lee and Merriam, 1954, pl. 1).

The structure on the Lansing is irregular but shows a slight elongation in the northwest-southeast direction. There is about 20 feet of closure on this datum (Figure 4). The structure on the Stone Corral is also irregular and shows only about 18 feet of closure. The crest of the anticline is located almost in the same place at both horizons.

Jennings field was discovered in 1951 and produces from the Wabaunsee group and from the Lansing-Kansas City at depths of 3156 and 3478 feet, respectively, in the discovery well. The field covers 720 acres.

Structurally it is situated on the Jennings anticline which borders the western side of the Cambridge arch (Merriam and Atkinson, 1955). The Jennings anticline has already been discussed under the Adell field.

The structure map on the Lansing group (Figure 5) reveals that the production is from a north-south elongated closed anticline. There is about 13 feet of closure on the structure, but inasmuch as the crest of the structure is yet undrilled, greater closure may be revealed later. The west flank of the structure is steep in comparison to the east flank. The closure on the Stone Corral amounts to about ten feet. The structure on the Stone Corral is closely similar to the structure on the Lansing.

Law field was discovered in 1951, covers 860 acres, and produces from the Lansing-Kansas City and Pennsylvanian basal conglomerate at depths of 3922 and 4126 feet, respectively, in the discovery well.

Structurally, the field is situated on the northern end of the central Kansas uplift just south of a large broad synclinal area which separates the central Kansas uplift from the Cambridge arch. Its regional structural position is similar to that of the Hayden field in Rooks County.

The structure on the Lansing (Figure 6) reveals an elongate north-south trending symmetrical anticline with a closure of about 16 feet. The structure on the Stone Corral coincides approximately with the structure on the Lansing and also shows about 16 feet of closure. The closure on the Stone Corral occurs, however, in two separate areas whereas there is only one large closure on the Lansing.

Nunn field was discovered in 1938 and produces from the Kansas City,

About the Author

DANIEL F. MERRIAM of the Kansas State Geological Survey is currently researching western Kansas' subsurface structure and stratigraphy. Until 1951 he was a Union Oil Company of California geologist, after getting his B.S. from the University of Kansas in 1949. He has been a university geology instructor, a Rocky Mountain and West Texas surface explorer, and his investigations have been published by the Survey.

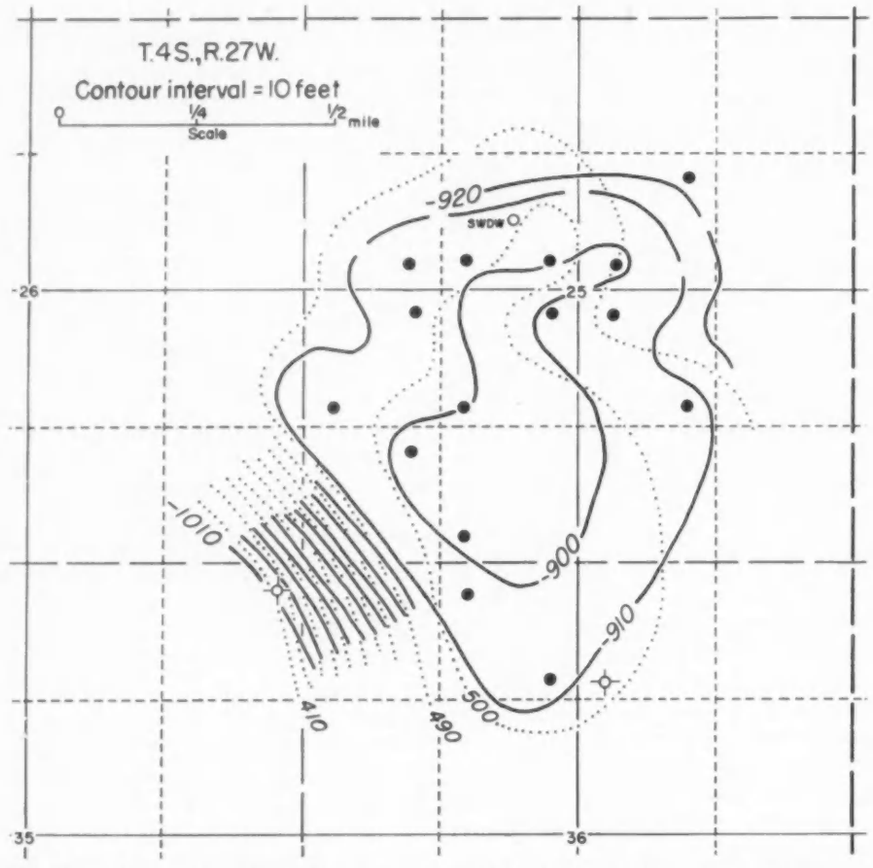


FIGURE 5 (above)—Stone Corral (dotted contours) and Lansing (solid contours), Jennings oil field.

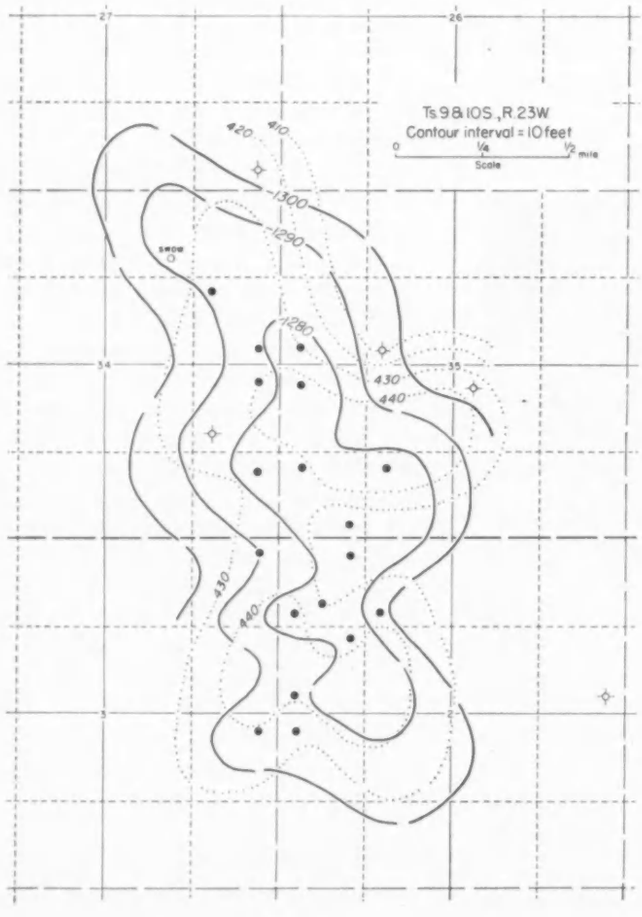


FIGURE 6 (below)—Stone Coral (dotted contours) and Lansing (solid contours), Law oil field, Graham County.

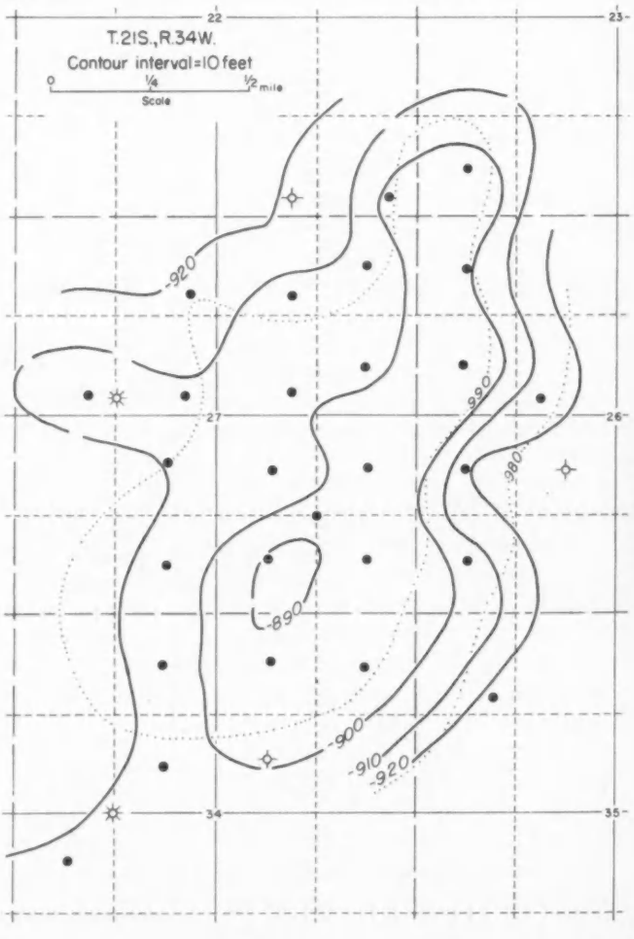


FIGURE 7—Stone Corral (dotted contours) and Lansing (solid contours), Nunn oil field, Finney County.

Marmaton, "Cherokee" and "Mississippi lime." Production from the "Cherokee" is at 4550 feet and from the "Mississippi lime" at 4654, respectively, in the discovery well. The field covers an area of 1300 acres.

Structurally, the Nunn field is situated on a northeast-southwest trending anticline on the west flank of the western Kansas basin as shown by Lee and Merriam (1954, pl. 1). The regional dip on the Stone Corral formation is northeastward. The Shallow Water and Keystone oil fields are also located on the same structural trend.

The structure on the Lansing (Figure 7) reveals a northeast-southwest trending closed anticline with about 13 feet of closure. The structure on the Stone Corral has only about ten feet of closure. The two structure maps coincide closely.

Ruggles field was discovered in 1952 and produces from the Shawnee, Lansing-Kansas City, and Pennsylvanian basal conglomerate at depths

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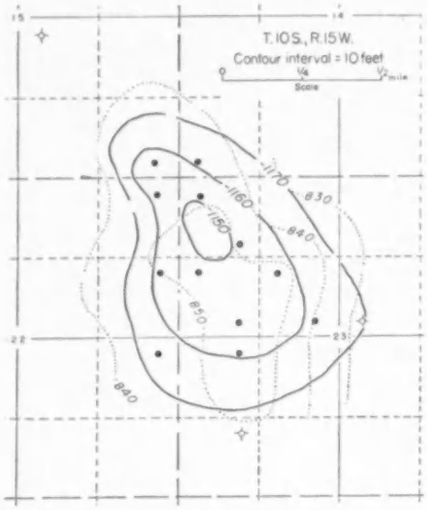

FIGURE 8—Stone Corral (dotted contours) and Lansing (solid structure), Ruggles oil field, Osborne County.

of 2986, 3024, and 3394 feet, respectively, in the discovery well. The field covers an area of 640 acres.

Structurally the field is situated in the Salina basin just east of the east margin of the central Kansas uplift. It seems to be on the same anticlinal axis as the Fairport anticline (Lee and Merriam, 1954, pl. 1). It is the only producing field in Osborne County.

The structure on the Lansing (Figure 8) is an ovate north-south trending anticline with closure of about 20 feet. The Stone Corral structure is similar to that of the Lansing but is wider. Closure as shown on the Stone Corral is about nine feet.

Stuttgart field was discovered in 1950 and produces from the Lansing-Kansas City at a depth of 3146 feet in the discovery well. The field covers an area of 600 acres.

Structurally it is situated on the Stuttgart-Huffstutter anticline which parallels the eastern edge of the Cambridge arch and trends northeast-southwest. It is separated from the Cambridge arch by the northeasterly plunging Long Island syncline (Lee and Merriam, 1954, pl. 1; Merriam and Atkinson, 1955). There are several major oil fields located on this structure including the Huffstutter, Dayton, Stuttgart, Hansen, and Ray fields.

The structure on the Lansing (Figure 9) reveals a northeast-southwest trending anticline with a closure of about 28 feet. The southeastern flank of the anticline is steep compared with the northwestern flank. Two separate areas of closure occur in the field. The Stone Corral structure also shows a northeast-southwest trending anticline with about 47 feet of closure. The southeastern flank is steeper than the northwestern flank. The structure on the two horizons is remarkably similar, except for the displacement of the crest of the Stone Corral east of the closure on the Lansing.

Sunny Slope field was discovered in 1952 and produces from the Marmaton at a depth of 3848 feet. It covers 640 acres.

Structurally the field is situated in

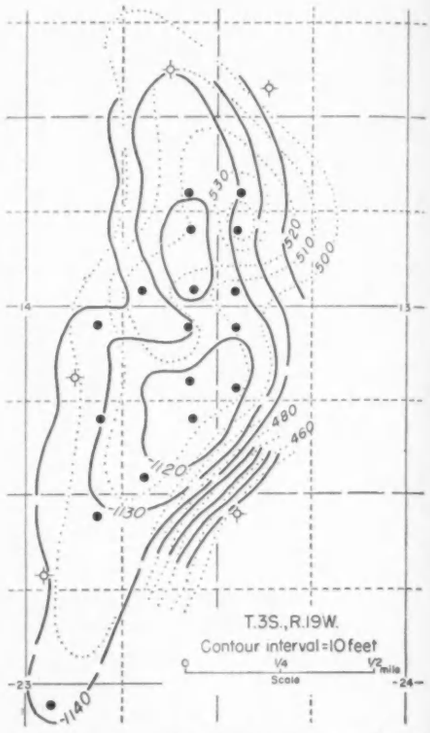

FIGURE 9—Stone Corral (dotted contours) and Lansing (solid contours), Stuttgart oil field, Phillips County.

the western Kansas basin just southwest of the western margin of the central Kansas uplift. It occurs on a minor structural trend which parallels the uplift in a northwest-southeast direction and plunges northwestward (Lee and Merriam, 1954, pl. 1).

The structure on the Lansing (Figure 10) reveals a northwest-southeast trending anticline with about 13 feet of closure. The southern margin of the field is vague because no wells

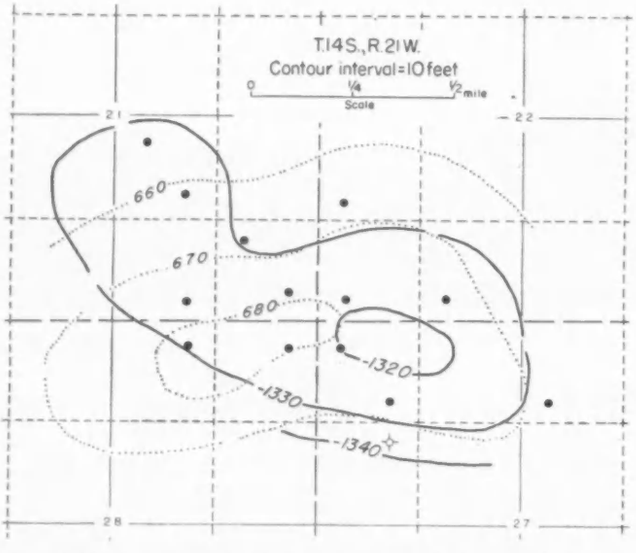

FIGURE 10—Stone Corral (dotted contours) and Lansing (solid contours), Sunny Slope oil field, Trego County.

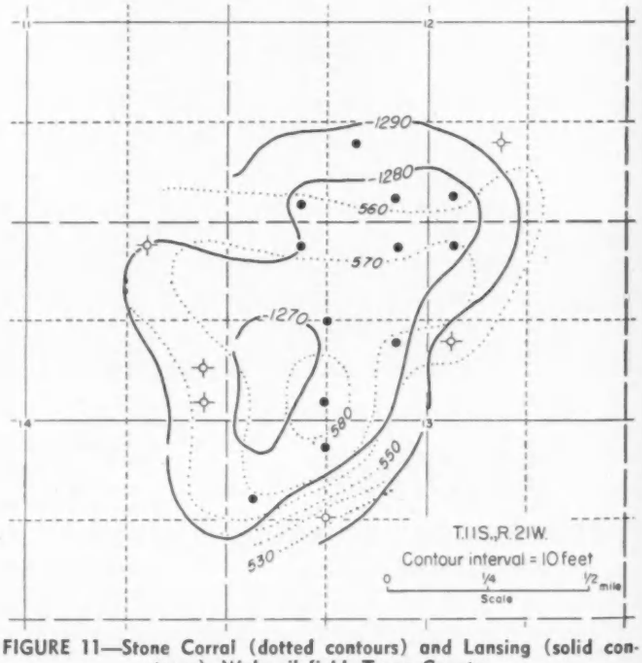

FIGURE 11—Stone Corral (dotted contours) and Lansing (solid contours), Walz oil field, Trego County.

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have been drilled on this side. The structure on the Stone Corral is also a closed anticline but the crest is displaced to the west of the closure as shown on the Lansing.

The closure on the Stone Corral seems to be about 14 feet although this is questionable because of the lack of information on the southwest flank of the anticline. The similarity of structure on the two horizons is slight, possibly due in part to lack of data toward the southwest, but both show closure in the general vicinity.

Walz field was discovered in 1950 and produces from the Lansing-Kansas City and Arbuckle at depths of 3428 and 3666 feet, respectively, in the discovery well. The field covers 700 acres.

Structurally the field is situated on the northern end of the central Kansas uplift just south of a large broad synclinal area which separates the uplift from the Cambridge arch. The relation of the field to the regional structure is similar to that of the Hayden and Law fields.

The structure on the Lansing (Figure 11) shows an elongated anticline which trends in a northeast-southwest direction and which has about ten feet of closure. The Stone Corral structure also trends northeast-southwest and has closure of about 16 feet. The two structures are almost identical in shape and structural relief although the Stone Corral crest is slightly east of the Lansing crest.

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Filed Data Could Reveal New Appalachian Fields

Significant reserves of oil and gas remain to be discovered in the Appalachian Basin, and the finding of them could be facilitated by the pooling and dissemination of information now lying uselessly in files and notebooks.

This statement was made before the Pennsylvania Grade Crude Oil Association in Pittsburgh recently by Dr. Herbert P. Woodward, dean and professor of geology at Newark College of Rutgers University, Newark, N. J.

"We need to revise our thinking, improve our geological knowledge, and plan future exploration before we can count on finding or developing these reserves to the best and least costly advantage," he said.

Many parts of the Appalachian Basin, particularly its deeper and more easterly regions, have scarcely been prospected, the speaker asserted. "There are new angles of approach, new geologic theories of the origin and occurrence of oil," he said, "and new applications that have never adequately been tested."

To revive American interest in the Appalachian country, he called for leadership in faith and optimism, as well as cooperative action.

"In company files or inactive field notebooks lies a great volume of useful information doing no one any good," he said. "If it could be brought together and coordinated, it might provide geologic data needed to solve a particular problem." He urged that some effort be made to collect, coordinate, classify and disseminate geological information to those concerned.

"The target should no longer be the success of some local project," he said. "Rather it should be the improvement of the oil and gas industry throughout the entire basin."

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Wildcat Drilling—in July and First Seven Months, 1955-1954

STATE or DISTRICT	MONTH OF JULY, 1955						FIRST SEVEN MONTHS, 1955-1954								
	New Fields			Total Discoveries	Dry Wildcats	Total Wildcat Tests	New Fields			Total Discoveries		Dry Wildcats		Total Wildcat Tests	
	Oil	Distillate	Gas				Oil	Distillate	Gas	7 Mo. 1955	7 Mo. 1954	7 Mo. 1955	7 Mo. 1954	7 Mo. 1955	7 Mo. 1954
Alabama	..	....	..	....	2	2	...	..	...	...	...	30	41	30	41
Arizona	..	....	..	....	....	....	...	..	...	...	...	4	8	4	8
Arkansas	3	....	..	3	6	9	8	..	2	10	3	68	51	78	54
California	2	....	1	3	29	32	12	..	3	15	14	173	184	188	198
Colorado	2	....	..	2	86	88	24	1	15	40	42	442	275	482	317
Florida	..	....	..	....	3	3	...	..	...	...	1	19	17	19	18
Georgia	..	....	..	....	....	....	...	..	...	...	...	....	7	....	7
Idaho	..	....	1	1	....	1	...	..	1	1	...	2	....	3	....
Illinois	6	....	1	7	85	92	12	..	2	14	16	376	334	390	350
Indiana	1	....	..	1	11	12	9	..	1	10	10	89	139	99	149
Kansas	13	....	4	17	100	117	92	..	25	117	72	536	442	653	514
Kentucky	2	....	1	3	10	13	12	..	2	14	20	63	28	77	48
Louisiana	4	3	2	9	54	63	23	15	2	40	46	265	215	305	261
North Louisiana	2	1	..	3	24	27	5	2	...	7	7	101	77	108	84
South Louisiana	2	2	2	6	30	36	18	13	2	33	39	164	138	197	177
Michigan	..	....	..	....	13	13	2	..	...	2	8	111	132	113	140
Mississippi	1	....	..	1	9	10	6	1	...	7	2	97	88	104	90
Missouri	..	....	..	....	....	....	...	..	...	...	...	17	6	17	6
Montana	1	....	..	1	14	15	5	..	...	5	5	55	46	60	51
Nebraska	4	....	..	4	38	42	23	..	...	23	16	182	64	205	80
Nevada	..	....	..	....	....	....	...	..	...	...	1	4	7	4	8
New Mexico	4	....	3	7	14	21	16	1	15	32	37	89	100	121	137
North Dakota	2	....	..	2	5	7	3	..	...	3	1	26	61	29	62
Ohio	..	....	..	....	....	....	...	..	1	1	...	13	7	14	7
Oklahoma	10	2	2	14	60	74	58	7	12	77	85	351	416	428	501
Oregon	..	....	..	....	....	....	...	..	...	...	...	1	....	1	....
Pennsylvania	..	....	1	1	....	1	...	..	1	1	...	2	....	3	....
South Dakota	..	....	..	....	....	....	....	..	...	....	1	6	9	6	10
Texas	39	7	6	52	364	416	306	48	39	393	427	2,377	2,414	2,770	2,841
Dist. 1: South Central	5	....	..	5	25	30	16	4	1	21	25	231	162	252	187
Dist. 2: Middle Gulf	..	....	1	1	27	28	8	9	6	23	24	143	153	166	177
Dist. 3: Upper Gulf	1	3	1	5	41	46	10	13	7	30	25	241	234	271	259
Dist. 4: Lower Gulf-S.W.	5	3	1	9	24	33	18	12	5	35	33	237	217	272	250
Dist. 5: East Central	..	....	..	....	15	15	3	2	...	5	...	80	82	85	82
Dist. 6: Northeast	..	....	..	....	20	20	3	3	...	6	5	108	91	114	96
Dist. 7-B: North Central	13	....	..	13	98	111	92	..	7	99	119	510	505	609	624
Dist. 7-C: West Central	3	....	1	4	25	29	22	..	5	27	37	164	203	191	240
Dist. 8: West	1	....	..	1	25	26	46	..	1	47	67	262	243	309	310
Dist. 9: North	11	1	2	14	58	72	86	1	6	93	82	373	488	466	570
Dist. 10: Panhandle	..	....	..	....	6	6	2	4	1	7	10	28	36	35	46
Utah	1	....	1	2	5	7	6	..	3	9	4	35	18	44	22
West Virginia	..	....	..	....	....	....	...	..	7	7	...	10	....	17	....
Wyoming	4	....	..	4	21	25	16	..	2	18	49	100	117	118	166
Total United States	99	12	23	134	929	1,063	633	73	133	839	860	5,543	5,226	6,382	6,086

Wildcatting Volume Grows

But successes fail to keep pace.

By CECIL W. SMITH, WORLD OIL Staff

U. S. WILDCAT drilling activity continues to gain momentum and records show that July was the busiest period this year. More tests were completed than in any preceding month, and the 1063 wells finaled put July in the exclusive 1000-per-month circle. June also gained this distinction and for the first time in history consecutive months reached that level.

July's record performance boosted the year's seven-months total into a lead of almost 5 percent over last year's best efforts. A month earlier, the margin had been 4.3 percent in favor of this year's operations.

During the first seven months, a total of 6382 rank wildcat tests was drilled, giving the year's campaign a lead of 4.9 percent over last year's record-breaking 6086 tries in the same period. Wildcatting is expected to maintain the pace during the remainder of the year with final total wells topping last year's all-time high by about 4.6 percent.

Despite the increase in activity, success has been disappointing in comparison with last year's. The additional 296 wildcats drilled so far this year failed to add to the nation's oil and gas reserves. In fact, the search, so far, has not lived up to last year's standard, numerically. By the end of July, last year, discoveries had added to 860, which was 21 more than the 839 recorded to date.

Thus, all of the year's gain in operation has been absorbed into the costly dry hole category. Costly from the very nature of the operation, and even more costly this year than last.

Summary of Results of Wildcat Drilling

ITEM	July, 1955	June, 1955	SEVEN MONTHS January-July 1955	1954	Percent Diff.
New Field Discoveries:					
Oil	99	127	633	646	— 2.0
Distillate	12	15	73	72	+ 1.4
Gas	23	28	133	142	— 6.3
Total Discoveries	134	170	839	860	— 2.5
Dry Wildcats	929	856	5,543	5,226	+ 6.1
Total Wildcat Tests	1,063	1,026	6,382	6,086	+ 4.9
Percent Productive	12.6	16.6	13.1	14.1	.....
Percent Dry	87.4	83.4	86.9	85.9	.....

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By W. E. BERGMAN, J. R. HURLEY and F. J. SHELL,
Phillips Petroleum Company, Research Division, Bartlesville

CEMENTING OF CASING is an important operation in the drilling and completion of oil wells and for successful cementing operations certain fundamental physical properties of the cement slurry are required.

The slurry must be fluid long enough to permit it to be pumped into place and then it must set up with sufficient strength to support the casing. This set cement must be impermeable enough to keep corrosive fluids from the casing and to prevent fluids from migrating from one formation to another. Neat slurries of common portland cement fulfill these requirements in many cases; however, other problems arise with their use. These auxiliary problems are generally the result of three properties of the slurry; namely, density, thickening time and water-loss.

The ideal cement slurry density is one equal to that of the drilling mud. Cement slurries having densities as low as 13 pounds per gallon can be formulated with portland cement admixed with bentonite and various pozzolanic materials.[16, 18, 20, 21] There exists a considerable gap between this density and that of the mud used in many drilling operations. In some cases it is necessary to overcome this density differential by costly stage cementing.

The thickening time is controlled by varying the composition and physical properties of the cement and by the use of organic additives. Commercial cements are available for cementing to depths of about 16,000 feet where static bottom hole temperatures are around 300° F. There is no reason to believe that cements capable of being pumped to greater depths cannot be developed.

With regard to water-loss, neat cements have fiiltration rates in the range of 400 to 1000 ml, API.[3] Gel cements containing calcium lignosulfonate generally have water-loss values greater than 100 ml.[18, 19] At the present time only one cement is sold as a low water-loss cement, although many such systems are described in the patent literature.[4, 11, 12, 13, 14, 15, 17]

Many of the advantages of low water-loss cements are the same as for low water-loss drilling fluids and need not be enumerated. In addition, there are other less obvious reasons for using low water-loss cement. To minimize channelling and obtain a better cement job, it is desirable to rotate or reciprocate the casing.[9] This is most valuable when scratchers are employed to remove the mud cake and puddle the cement. The danger of sticking the pipe with dehydrated cement is essentially removed with the use of low water-loss cement. Even when it is not desirable to move the casing during cementing, the usual danger of flash set because of cement dehydration is removed by the use of low water-loss cement. Low water-loss cement is also necessary for success of permanent-type well completion.[10] An indirect advantage should be better fill-up, i.e. since loss of water is small, each cubic foot of slurry mixed should occupy one cubic foot in place.

To satisfy the special requirements of the petroleum industry, cement research at Phillips Petroleum Company has been directed at development of oil-well cements suitable for use over a wide range of densities and

PART 1

*Field tests are continuing

having a low filtration rate. Numerous materials were tested as additives to portland cement to achieve this objective. A cellulose derivative-carboxymethyl hydroxethyl cellulose (CMHEC)—having tailor-made physical and chemical properties was found most promising for controlling the water-loss and for retarding the thickening time. A special grade of diatomaceous earth (DE) admixed with portland cement permits formulation of low density slurries.

This is a report of the progress of Phillips' research on these new cements. Pertinent studies related to their development and principles governing their composition or application are reviewed. The application of these cements in wells is being demonstrated by field tests.

EXPERIMENTAL

Materials

1. Cement: Common portland cement (API Class A or ASTM Type I[1]) from various sources was used.

2. Chemicals: Most of the chemical reagents were of CP grade, and the amount used was corrected for moisture, if present.

Test Procedure. Unless otherwise specified the portland cement was blended with other dry ingredients prior to mixing with the desired amount of water for 35 seconds in a blendor. The concentration of the various ingredients is expressed as percent which in cement terminology means parts by weight per 100 parts of cement rather than percent by weight of the mixture. Details of some of the special equipment and procedures are described in API RP 10B.[2] As used in this laboratory, however, the equipment has been improved to permit automatic control and recording of temperature. Briefly, these tests and their significance are:

1. Thickening Time: Thickening-time tests are designed to determine the length of time a given cement slurry remains fluid under given laboratory conditions. In actual practice, of course, this time must be sufficient to allow the slurry to be pumped into place. To measure the thickening time the slurry is placed in a rotating, cylindrical cup containing a stationary paddle. The torque on the paddle is a measure of the slurry's consistency.

The time required for the slurry to reach 100 poises is called the thickening time and is dependent upon both temperature and pressure. Such determinations at atmospheric pressure were made with consistometers. The pressure and temperature changes experienced when a cement is pumped down a well were simulated when the measurements were taken with a super-pressure consistometer.

2. Compressive Strength: Another requirement is that the cement, after being pumped into place, should develop adequate strength within a reasonable time—24 to 48 hours. In general, tensile strengths on the order of 10 to 50 pounds per square inch or compressive strengths of 200 to 500 psi are considered adequate.[5,8] Temperature and pressure are the important variables here also. In general, increase in temperature to about 220° F. and of pressure to about 2000 psi increase the rate of strength attainment.[6,22] The magnitude of the effect of these variables cannot be predicted, so that cement curing under simulated well conditions is of utmost importance. Special apparatus was constructed for such curing. Much of the data on compressive strength was obtained with this equipment using temperature and pressure schedules proposed by API.[22] For other tests the cements were cured at atmospheric pressure in thermostated water baths. The compressive strengths were measured according to the procedure given by API.[2]

3. Maximum and Minimum Water Contents: In this report the maximum water is defined as the largest percent which may be contained in the slurry without getting appreciable settling of the solids in the slurry or bleeding of water at the surface. For the measurement, slurries were poured in 250 ml mixing cylinders and permitted to remain quiescent for three hours.

The amount of bleeding under these conditions should be less than one percent by volume, and the upper and lower portion of the slurry should have the same density to within ±0.1 pounds per gallon. The minimum water is the least amount which may be used without exceeding a consistency of 25 or 30 poises during the first 15 minutes as determined with the high pressure consistometer. The recommended water content or slurry density is generally midway between the maximum and minimum values.

4. Water-Loss: The filtration rates of cement slurries were determined by the procedure used with drilling fluids.[3] The initial water-loss values were determined at room temperature immediately after mixing the slurry. To estimate the effect of time and temperature upon the water-loss, samples were placed in the consistometer which was heated at a rate of 2.0° F. a minute to 180° F. and then maintained at that temperature. At the end of the desired aging period, the samples were transferred to filter presses which were also maintained at 180° F.

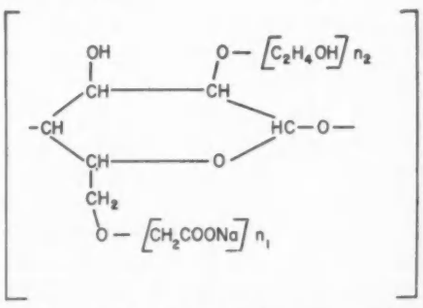
In a few cases, samples were aged while quiescent in sealed jars placed in an oven at 180° F. Under the experimental conditions the average heating rate in the oven was approximately 0.85° F. a minute. These samples were filtered while hot; however, the filter presses were at room temperature so the slurry temperature continually decreased during the 30-minute period. The results agreed satisfactorily with the more rigorous procedure described above. Some special water-loss determinations were also made and will be described when those results are discussed.

RESULTS AND DISCUSSION

The presentation will be divided into sections which will illustrate the important factors relating to practical development of these cements. The first will show results with neat slurries of common portland in order to illustrate principally the effect of CMHEC. The second section will extend the results to low density slurries prepared with mixtures of portland cement and diatomaceous earth (DE).

Low Water-Loss, Neat Cement

CMHEC is a synthetic chemical. Its formula may be represented schematically as:



The molecular weight or number of anhydroglucose units in the polymer chain and the number n_1 and n_2

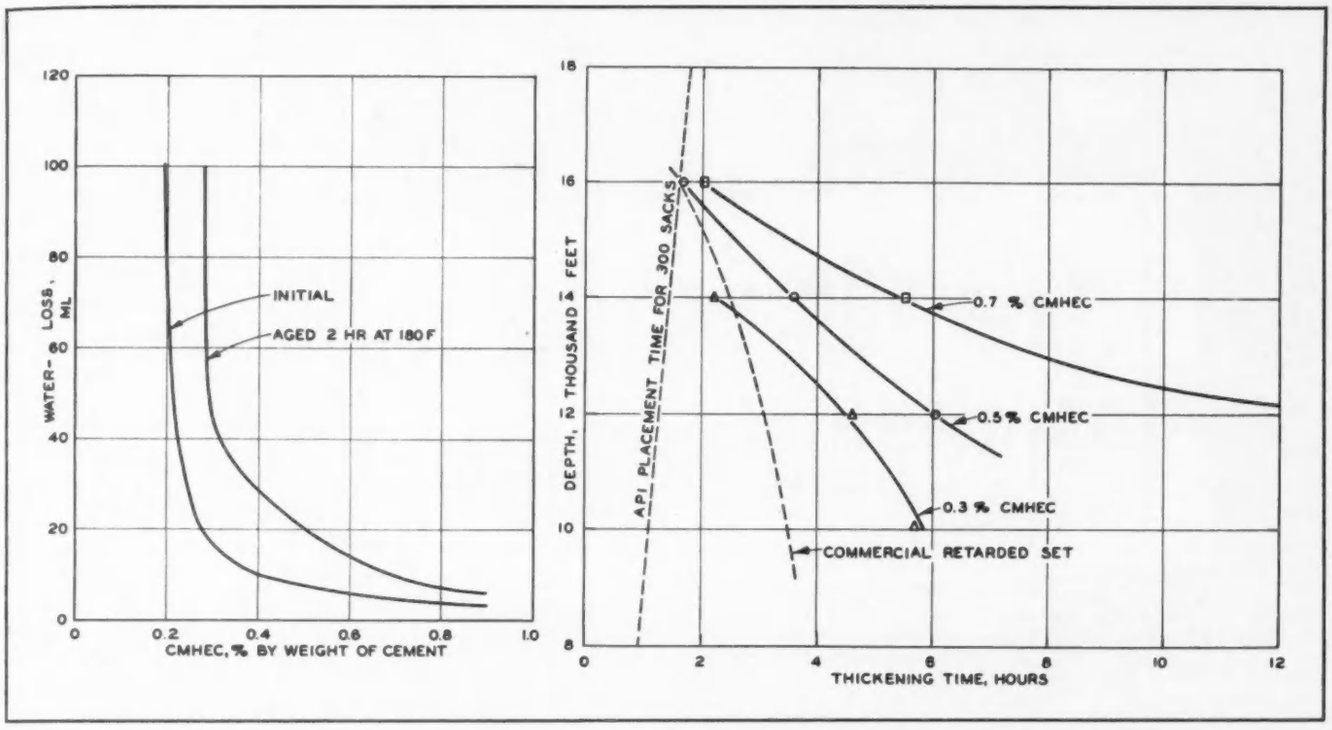


FIGURE 1—The water-loss of 15-ppg slurries of Class A cement containing CMHEC.

FIGURE 2—Thickening time as a function of well depth for 15-ppg slurries of Class A cement containing 0.3, 0.5 and 0.7 percent CMHEC.

of carboxymethyl and hydroxethyl units per anhydroglucose unit may be varied during its synthesis. Numerous products were tested to establish the relationship of the physical—chemical properties to the reaction in experimental cements. A satisfactory product was chosen for the work reported here.

The effect of the concentration of CMHEC upon the water-loss of 15 pounds-per-gallon slurries of neat cement is illustrated in Figure 1.

For concentrations of CMHEC less than 0.3 percent the water-loss value is very sensitive to change in concentration of CMHEC. There is some variation in control with different lots of cement, but in general the initial water-loss value will be less than 20 ml when 0.3 percent CMHEC is admixed with the cement and will decrease with increasing CMHEC concentration.

Water-loss values increase as the slurry ages. The extent of the increase is a function of the concentration of CMHEC, and the time and temperature of aging. For slurry being pumped in a well it is desirable to maintain a low water-loss as long as the slurry is being pumped. Therefore, the concentration of CMHEC must be sufficient to give the desired initial value for water-loss and to maintain a low water-loss while the cement is pumped. The recommended compositions for low water-loss cements which have been developed, as will be shown, include sufficient CMHEC to give an initial water-loss value below 20 ml. The water-loss after pumping the cement in place will generally be less than 40 ml.

Tests established that the degree of water-loss control is not dependent upon the filter medium. Replacement of the filter paper in the press with graded sand (30 to 60-mesh), alundum discs, or a 325-mesh screen showed that these cements will not be dehydrated by loss of water through formations having a rather high permeability.

The tests reported above were with 15 pounds per gallon slurries. The minimum water value for these cements is approximately 40 percent (16.3 pounds-per-gallon slurry density) for concentrations of CMHEC to about 1 percent. The maximum water content increases with increase in concentration of CMHEC, being approximately 83 percent (13.3 pounds-per-gallon slurry density) when using 0.5 percent CMHEC and greater than 90 percent with 0.7 percent CMHEC. For simplicity, most of the development work with neat cement was with 15 pounds-per-gallon slurries prepared with 54 percent water. However, moderate variation in the water content, such as would occur under field conditions does not affect the practicality of the cement.

The next step was to determine whether CMHEC modified cement would have adequate thickening time to permit placement in a well and to define the well conditions under which it might be used.

Figure 2 shows the thickening time under simulated well conditions for 15 pounds-per-gallon slurries prepared with Class A cement containing 0.3, 0.5 and 0.7 percent CMHEC.

These results demonstrate that CMHEC is an effective retarder of the thickening time since Class A cement without additives cannot be pumped to depths greater than about 6000 feet API. With 0.3 percent CMHEC the thickening time is adequate for pumping to depths of about 14,000 feet. As previously shown, the water-loss value will be less than 20 ml when the concentration of CMHEC is 0.3 percent or more.

The thickening time of the cements containing 0.5 or 0.7 percent CMHEC is greater under comparable conditions than for a typical commercial retarded set cement. The results dem-

TABLE 1

The Effect of Temperature and Pressure Upon the Thickening Time of 15 Lb/Gal Slurries of Class A Cement Containing CMHEC

CMHEC, Percent	SIMULATED WELL CONDITIONS					
	Depth, Ft.	Static BHT, F	Circulating BHT, F	Pressure, psi	Time to Place, Hr:Min.	Thickening Time, Hr:Min.
PART A. Effect of Temperature						
0.5	12,000	244	154	10,200	1:14	8:00
0.5	12,000	260	172	10,200	1:14	6:04
0.5	12,000	290	206	10,200	1:14	3:57
0.5	14,000	254	164	13,400	1:24	5:12
0.5	14,000	290	206	13,400	1:24	3:38
0.5	14,000	330	260	13,400	1:24	1:48
0.7	14,000	254	164	13,400	1:24	10:30
0.7	14,000	290	206	13,400	1.24	6:31
0.7	14,000	330	260	13,400	1:24	1:56
0.7	14,000	330	260	13,400	1:24	2:00
PART B. Effect of Pressure						
0.5	12,000	260	172	8,200	1:14	5:16
0.5	12,000	260	172	10,200	1:14	6:04
0.5	12,000	260	172	12,200	1:14	5:22
0.5	14,000	290	206	10,700	1:24	3:44
0.5	14,000	290	206	13,400	1:24	3:38
0.5	14,000	290	206	16,100	1:24	3:50

TABLE 2

The Effect of the Concentration of CMHEC and of Sodium Silicate Upon the 24-Hour Strength of 15 Lb/Gal Slurries of Neat Cement Slurries Cured Under Simulated Well Conditions

DEPTH, FEET	CMHEC, Percent	COMPRESSIVE STRENGTH, PSI, WITH INDICATED PERCENT SILICATE			
		0 Percent	1 Percent	3 Percent	5 Percent
2,000	0	2050	....	....	....
2,000	0.3	540	190	1360	1370
2,000	0.5	....	0	1080	1250
2,000	0.7	....	....	810	1080
4,000	0	2550	....	....	....
4,000	0.3	1880	2060	1820	....
4,000	0.5	600	1130	1810	....
4,000	0.7	0	280	1420	....
6,000	0	3040	....	....	....
6,000	0.3	3720	3470	2100	....
6,000	0.5	3450	2720	1300	....
6,000	0.7	2480	2430	2430	....

onstrate that these cements may be pumped safely as deep as 16,000 feet API. Concentrations of CMHEC higher than 0.7 percent might be used to obtain adequate retardation for pumping to depths greater than 16,000 feet.

Temperatures and pressure schedules in placing cement in any well may vary from those given in the API tests. Tests were conducted to cover the variation expected for most casing cementing operations. The effect of temperature was estimated by assuming bottom-hole circulating temperatures approximately 50° F. higher or lower than specified in the API code and holding all other conditions in the schedule constant. Similarly, bottom-hole pressures 20 percent greater or smaller were applied to determine the effect of pressure. The results in Table 1, Part A show that the temperature sensitivity of the thickening time is dependent upon the temperature and upon the concentration of CMHEC. For 12,000 foot wells using 0.5 percent CMHEC the average change in thickening time with temperature between 154 and 206° F. is 4.7 minutes per degree. At 14,000 feet this value between 164 and 260° F. is 2.7 and 5.3 minutes per degree using 0.5 and 0.7 percent CMHEC, respectively.

The effect of pressure at a given temperature on the thickening time (Table 1, Part B) is negligible for the pressure range covered. It should not be implied, however, that pressure has no effect since various workers have shown the marker effect of pressure on both the thickening time and compressive strength at much lower pressures.[6, 7, 22]

Thickening time determinations give information as to whether a cement can be placed in a well before it becomes too thick to be pumped. Compressive strength determinations tell whether the cement will be strong enough for operations at the end of normal waiting on cement time. The strengths developed by 15 pounds/gallon slurries of Class A cement containing 0.3, 0.5 and 0.7 percent CMHEC are shown in Table 2.

These data show that the 24-hour strength of the cement cured at simulated well conditions is dependent upon the concentration of CMHEC. To be assured of a 200 to 500 psi compressive strength at 24 hours, these and other tests show that this neat cement should not be placed higher than 4000 and 6000 feet when using 0.5 and 0.7 percent CMHEC, respectively.

Thus, the strength the cement will develop under well conditions must be considered in determining its applicability. As indicated the early strength of CMHEC cements may be increased by addition of sodium silicate.

Low Water-Loss, Low Density Cements

1. **Composition of the Slurries and Function of the Ingredients:** Two low density systems, designated as the 20 and 40 percent DE cements, will be

Continued on Page 124

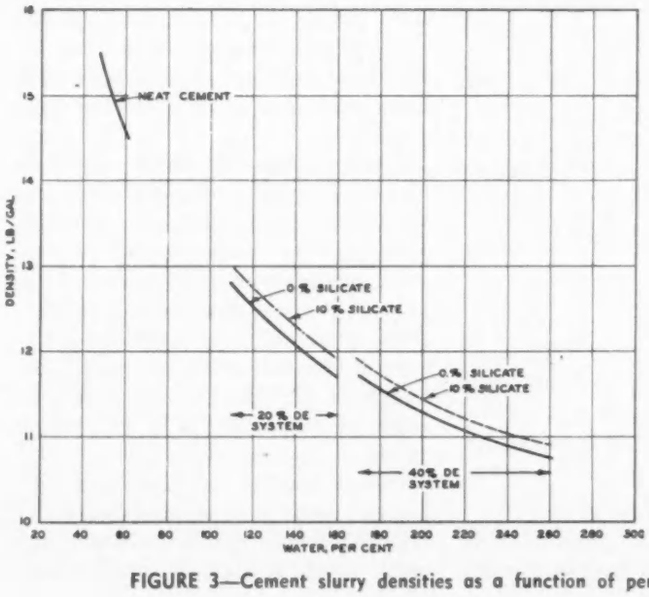


FIGURE 3—Cement slurry densities as a function of percent water.

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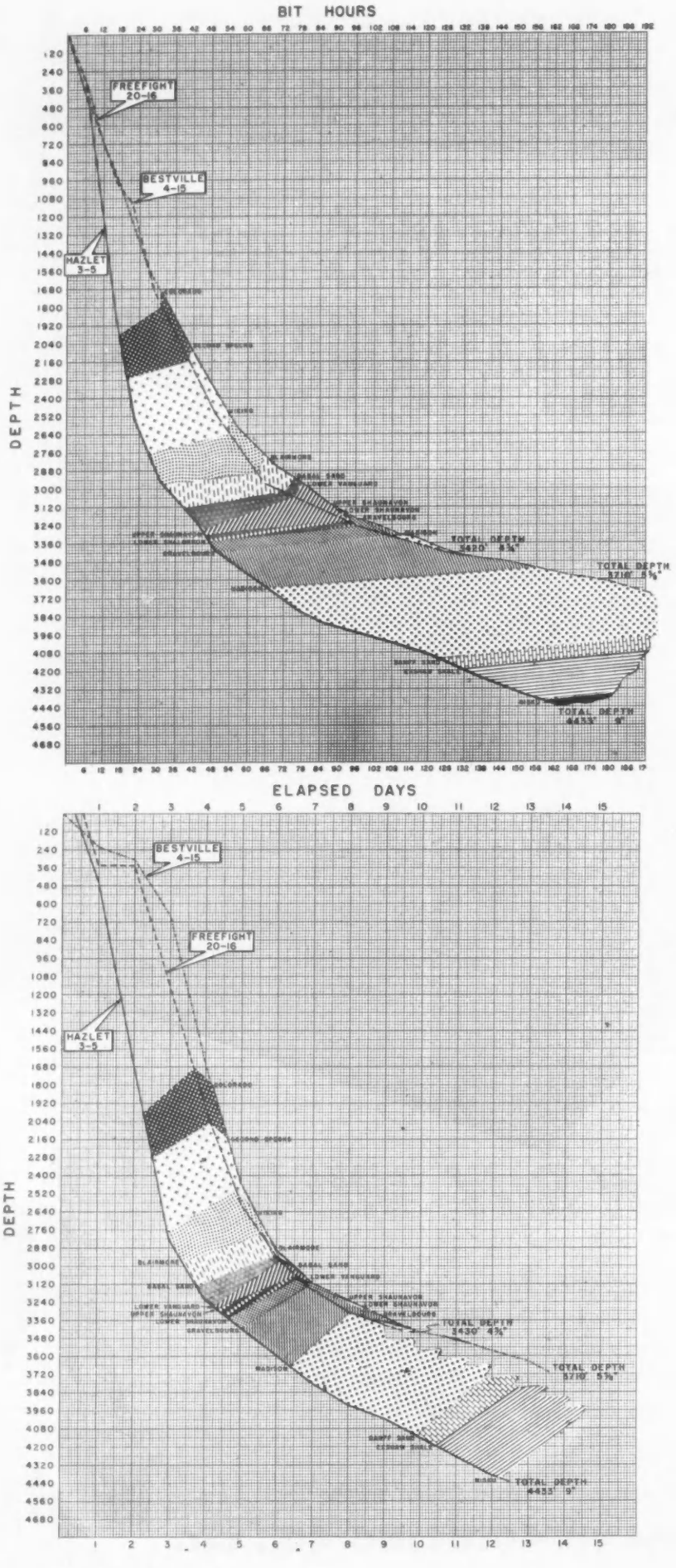

FIGURE 1—Curve shows elapsed days and bit hours versus well depth for the slim hole South Bestville and Freefight wells, as compared to Hazlet 3-5, which was drilled with a 9-inch diameter.

SOCONY-VACUUM SAYS:

Slim Hole Saskatchewan Than 9-Inch

Greatest promise lies in harder formation drilling . . . inaccessible exploratory wells with high transportation costs.

By F. M. J. VALINT,
Socony-Vacuum Oil Company of Canada, Ltd.

THE RECENT TREND toward slim hole drilling, the accompanying publicity, plus the successful completion of a series of 4¾-inch slim holes to depths of 4500 feet by a Canadian operator, prompted the Socony-Vacuum Oil Company of Canada Ltd., to inaugurate a slim hole test project for an evaluation of the feasibility and economics of this type drilling technique.

Ten slim holes—four drilled in the North Regina area, two holes in the Fosterton (Western Saskatchewan) area and the last four holes completed in the D'Arcy block (West Central Saskatchewan)—uncovered the conclusion that these completions, almost without exception, proved to be more costly than drilling a conventional nine-inch hole.

As no suitable yardstick was available to unquestionably confirm this assumption, it was necessary to base a final evaluation upon certain intangible evidence. A main contention is that it is hardly fair to compare the performance of a rig rated for 6000 feet operations with 4½-inch drill

Drilling In More Costly Conventional

pipe and the slim hole "seismic type" rig rated for 3700 feet using 2⅞-inch drill tubing.

A recap of this ten well experimental project did uncover certain advantages and disadvantages associated with slim hole drilling. In the order of their importance, the advantages of slim hole drilling are as follows:

- Transportation of the slim hole rig offers certain economic advantage.
- Casing installations are less expensive.
- Drilling fluid costs are reduced.
- The expense of well abandonment is less.

In contrast, experience has also shown the following disadvantages in slim hole drilling:

- Penetration rates are reduced.
- Fishing jobs are difficult because of limited work area.
- The possibility of blowouts become greater with reduced mud circulating volumes and rates.
- Completion reaming increases operation costs.
- The expense of drilling, geological, and engineering supervision is increased because of the extended time requirement for well completion.

In earlier experiments, two shallow hole rig contractors were used but it was found that the penetration rates made by these slim hole rigs were generally slow. It was then concluded that it would be advantageous for further tests to use a company service rig which had been converted for light drilling operations.

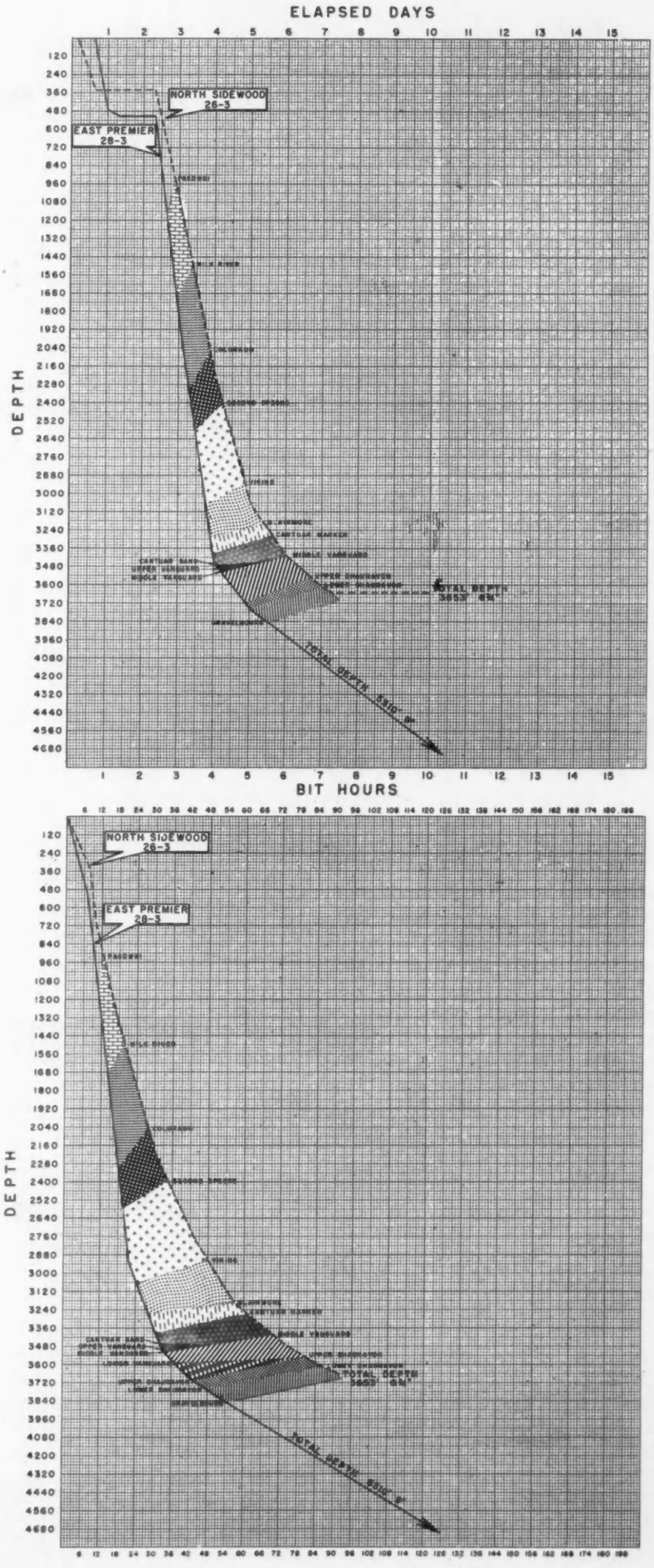

FIGURE 2—Graphic comparison of elapsed days and bit hours versus well depth recorded on North Sidewood 26-3, a 6¾-inch hole, and East Premier 28 which was completed with 9-inch well bore.

The decision was then reached to drill three holes with diameters of 4¾, 5⅝ and 6¾ inches respectively. The location of the first two holes was close, geologically similar, while the subsea elevations were near comparable. Therefore, it was assumed that conditions were ideal for test purposes and more accurate data could be assembled.

For a proper evaluation, the economics of the slim hole rig were compared to a nine-inch hole drilled by a company rig in the same general area. As this rig is also trailer-mounted and rated for 6000-foot operations, a fair comparison was considered possible. Therefore, the deductions set forth herein are based upon the performance of these two rigs in various size holes.

The first hole was drilled at South Bestville 4-15 with five 5⅝-inch bits, using 2⅞-inch 41-40 steel drill tubing equipped with modified I.F. tool joints. Although the mix water was slightly alkaline, little difficulty was experienced with drilling fluid control. Hole conditions were trouble free except for certain difficulty encountered in the penetration of a surface gravel bed which did reduce the final completion time to some extent. The drilling rate did not meet the planned schedule because five conventional bits were employed rather than the jet bits planned for the drilling program.

The second hole, Freefight 20-16, was drilled with 4¾-inch tools. By then, the rig crew was more familiar with handling and running drill tubing and, as a result, better penetration rates were recorded. A second advantage was by the fact that the desired bits were on location and hole problems were virtually non-existent.

The best drilling time was made on North Sidewood where 6¾-inch bits and 3½-inch I.F. drill pipe was employed and no difficulty was experienced during the program.

The first two holes are compared with Hazlet 3-5 which was drilled with nine-inch bits to the Nisku (D-3) formation. The three holes in question are located within the same general area. The last of the slim holes, completed with 6¾-inch bits, is compared to East Premier 28-3, a nine-inch hole, with comparable formation characteristics.

Penetration rates. The nine-inch hole was completed at a penetration rate almost 100 percent higher than the drilling time required to complete the slim hole. These rates are substantiated by Figure 1, showing the South Bestville and Freefight wells (slim holes 5⅝ and 4¾-inch diameters) as compared to Hazlet 3-5 which was completed as a nine-inch hole. Figure 2 compares the North Sidewood (6¾-inch) with the East Premier 28-3, a nine-inch hole.

Rates of penetration were tallied on automatic recorders, company rigs were used exclusively and comparable formations were encountered in those instances where test comparisons are made.

Although several different bit designs were tried, the jet type bit proved to be more successful from the standpoint of maximum penetration rates.

Circulating rates. Circulating rates employed in the different size holes drilled are shown in Table 1.

TABLE 1

Size Hole	4¾"	5½"	6¾"	9"
Circulating rate G.P.M.	150	180	240	485
Annualr Vel. between hole & D.P. ft./min.	250	190	175	200
Nozzle Velocity, Ft./sec.	208	249/192	197	207

TABLE 3

	10¾"	8⅝"
350' casing	$1,225.00 350'	$1,071.00
5 Centralizers @ $44.60	233.00 @ 38.50	192.50
4 5' Scratchers @ $11.80	47.20 @ 11.80	47.20
200 sacks cement @ $1.55	310.00 120 sacks	187.55
Cementing Services	180.00	180.00
Guide Shoe	46.02	37.65
Float Collar	72.33	63.76
	$2,103.55	$1,779.66

TABLE 2

	S. Bestville	Freefight	Hazlet	N. Sidewood	E. Premier
Total Depth	3710'	3410'	4433'	3653'	5310'
Comparable Depth	3710'	3410'	3710'	3653'	3800'
Size of Hole	5⅝"	4¾"	9"	6¾"	9"
Total Dr. Cost	$14,947.44	$11,798.26	$19,013.86	$10,525.77	$30,573.35
Dr. Cost to Comp. Depth	$14,947.44	$11,798.26	$11,725.20	$10,525.77	$10,542.50
Cost/Ft. T. D.	$4.03	$3.46	$4.29	$2.88	$5.75
Cost/Ft. C. D.	$4.03	$3.46	$3.16	$2.88	$2.77
Cost/Day	$786.70	$842.73	$1,267.59	$877.14	$1,054.25

Drilling cost comparison. To obtain a cost comparison between different rigs and hole sizes, a time basis should be used to evaluate the cost fairly. On this condition, the cost of slim holes drilled up to the present time is the same as a nine-inch hole and in some cases, even more.

To present a reasonable picture, the total number of days on the well versus the well depth was plotted. Those calculated costs are shown in Table 2.

If the actual per day cost is taken and applied against the attached graphs, it will be seen that the nine-inch holes, although more expensive on a per day basis, are less expensive in overall cost. Of course, it must be borne in mind that this is not necessarily true in the drilling of all different type formations; however, this situation does apply to Western Saskatchewan drilling to a given depth.

Table 3 indicates comparative costs for landing casing in the two different type well bores. It will be noted that the cost difference between the 10¾-inch and the 8⅝-inch equipment amounts to $323.89. In the event 6⅝-inch casing had been set, the cost difference would have been greater; however, with this installation, it would have been impossible to enlarge the hole.

An analysis of data derived from this long range test project has led the operator to believe that:

- In soft formations and at three to four thousand foot depths, as are encountered in Western Saskatchewan, slim hole drilling does not offer any advantage costwise.
- The greatest promise for slim hole drilling lies in harder formation operations and special application is seen in the deepening of cased wells.
- Slim hole operations may offer decided advantage on inaccessible exploratory wells where transportation costs are a large factor in the total operation expense.

ACKNOWLEDGMENT

This paper was presented at the spring meeting of the Canadian Association of Oilwell Drilling Contractors.

—The End

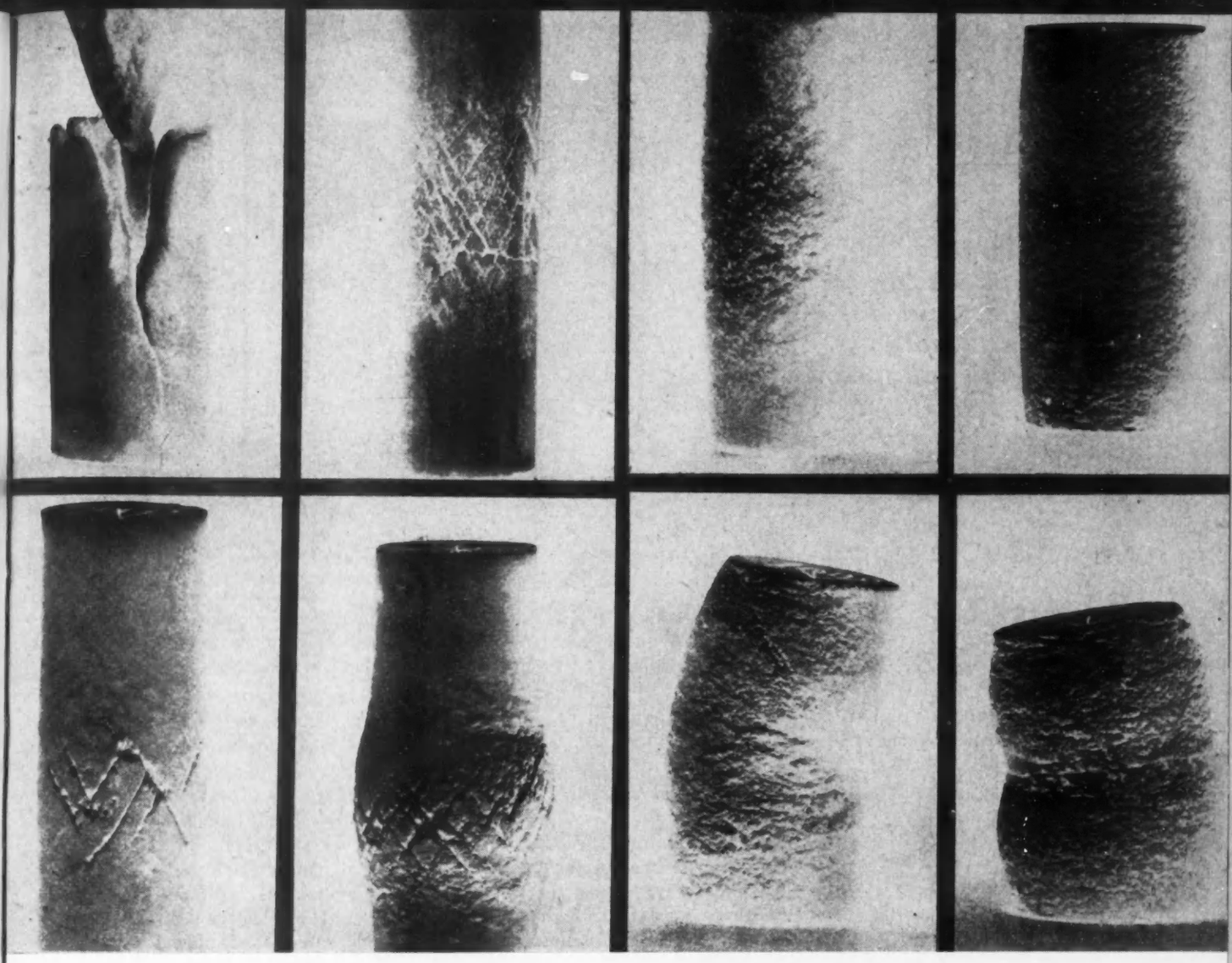

FIGURE 1a
Cylinders of marble after tests in axial compression under hydrostatic pressures of 0, 75, 240, and 500 atmospheres (after Ros and Eichinger[16]).

FIGURE 1b
After being tested in axial compression under hydrostatic pressures of 1000, 2000, 1000 and 1500 atmospheres (after Ros and Eichinger[16]).

Rock Strength: The Conditions of Failure

"THE DRILLING ENGINEER UNDER STRESS"

By DR. A. D. TOPPING, Goodyear Aircraft Corp., Cuyahoga Falls, Ohio

THERE ARE a number of reasons why the petroleum engineer, in particular the drilling engineer, should be interested in the strength of rock.

There are the problems of wall collapse in uncased holes and of formation fracturing, and even more directly concerned with the economics of drilling is the fact that penetration rates are a function of the strength of the rock which the bit is cutting. No study of these problems can be very fruitful which does not include a systematic investigation of rock strength.

The practical determination of the strength of a material is not simply a matter of loading specimens until they break and noticing that one carries more than another. One must decide under what condition of loading he wants to know the strength, and this will rarely be simple compression, tension, or shear. The drilling engineer is interested, fundamentally, in the strength of rock under the conditions which prevail at or near the sides and bottom of the drill hole.

Question:

What happens at or near the sides and bottom of the drill hole . . . affecting wall collapse, formation fracturing, and penetration rates?

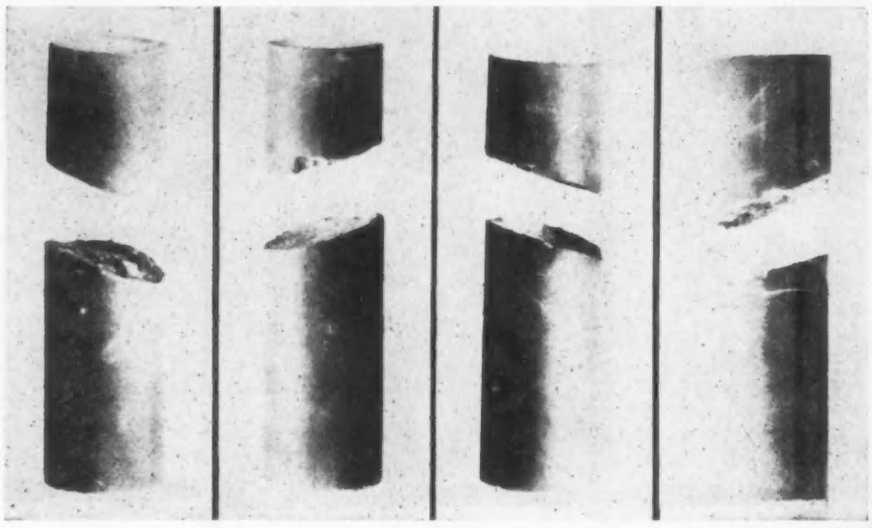

FIGURE 1c
Cylinders of marble after tests in axial tension under hydrostatic pressures of 1400, 1500, 1500, and 2170 atmospheres (after Ros and Eichinger[16]).

These conditions are not readily simulated in a test because they are conditions of triaxial loading, as distinguished from the uniaxial loading of an ordinary compression test, for example. Because of the difficulty and expense of making triaxial tests, it is desirable to find some relation which will make it possible to estimate strength under any loading from the fewest and simplest types of tests. For example, one might assume that strength in compression in some direction, X, is independent of any simultaneous stresses in the Y and Z directions; so that if the material is isotropic, a single uniaxial test is all that is needed. Unfortunately, experiment does not bear out this simple hypothesis.

There are still other complications to the question of strength. Are we interested in elastic strength, yield strength, or breaking strength? Rock is ordinarily considered a brittle material, but many experiments have shown that rock does yield plastically under certain conditions of triaxial loading (see Figures 1a, b, and c).

Though we may be interested in rupture, we must consider yielding first, especially since a material may yield without failure even though its rupture strength is no higher than its yield strength. There are still other aspects of strength, such as creep and the influence of temperature, but they must be disregarded in the present brief discussion.

Beginning with Coulomb in 1773,[1] many "theories of strength" have been proposed to predict the strength of materials under combined loadings from a single simple test. Most of these were originally thought to be applicable to both yielding and fracture, but it is now recognized that yielding is a shearing phenomenon while fracture may be the result of either shearing or normal stresses, or both.

The two most successful theories for the yielding of ductile metals have been the maximum shear theory and the distortion energy or octahedral shear theory. In a uniaxial test, shearing tresses occur on inclined planes, being maximum on planes at 45 degrees to the loading axis; and the first theory says failure occurs when this maximum shearing stress reaches a limiting value which can be determined in a simple tensile test. For materials not equally strong in tension and compression, such as rock, it is clearly inadequate. The second theory is more accurate for metals, but likewise predicts equal strength in tension and compression. Its basis is nevertheless worth considering. From microstructural considerations, both yield and fracture criteria must be energy criteria[15]; and since a total strain energy theory does not agree with tests, only distortion (shearing) energy is considered. Nadai[2] showed that this was equivalent to putting

$$\tau_y = \text{const.} \qquad (1)$$

where τ_y is the octahedral shearing stress at the yield limit.

The concept of octahedral stress may require explanation. The octahedral planes are those which make the same angle with each of the principal axes, and regardless of the relative magnitudes of the three principal stresses, it can be shown that the magnitudes of the resultant shearing stresses on each of these planes are identical.

The same is true of the normal stresses. Thus three principal stresses can be replaced by two octahedral stresses, the third variable in the octahedral system being the direction of the shear on the octahedral plane. The deformational response of an isotropic material can similarly be reduced to two components: volumetric strains and octahedral shearing strains.

Rock is plainly not always isotropic; nevertheless, Birch and Bancroft[3] state: "Many of the departures from isotrophy observed at one atmosphere are due to differences of compactness in different directions, which disappear at high pressure . . . it seems improbable that they persist much below a kilometer." In the present discussion, isotrophy is assumed.

Although neither the maximum shear nor the octahedral shear theory are satisfactory for rock, both can be modified to give better agreement with test results by making the critical value of the shear a function of the normal stress on its plane, somewhat like friction.

The Mohr theory of strength, which is perhaps the most widely used for brittle materials, may be regarded as such a generalization of the maximum shear theory. Mohr showed that if the principal stresses at a point are plotted along an axis from a common origin, the radius of a circle having its center on the axis and passing through the algebraically largest and smallest stresses gives the maximum shearing stress, and that if such circles for all

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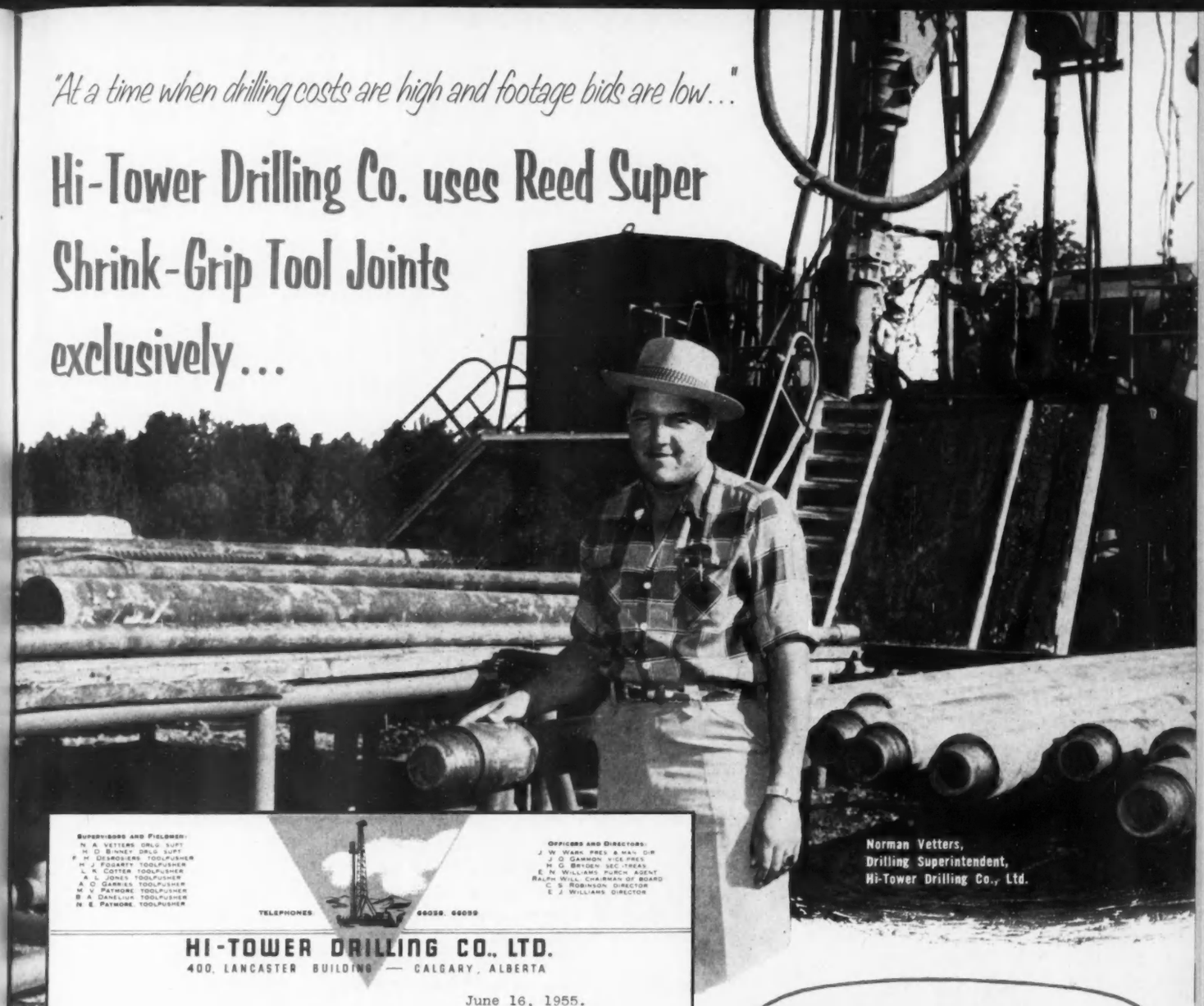

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Dear Mr. Wilson:

To supplement our conversation of this morning, I thought you might like to have the following information on the string of Reed Super Shrink-Grip Tool Joints used on our Rig No. 5 now moving into Saskatchewan:

Type of Tool Joint:	Reed 4½" Full Hole
Purchased:	July, 1951.
Footage Drilled as of June 16, 1955:	142,559'
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Locations:	Virden and Legal areas.

The performance of this string of joints is typical of the extra long service life we have received from all of the Super Shrink-Grip Tool Joints we have used and are presently using.

At a time when drilling costs are high and footage bids are low, we are especially pleased to have dependable Reed Tool Joints exclusively on each of our eight rigs.

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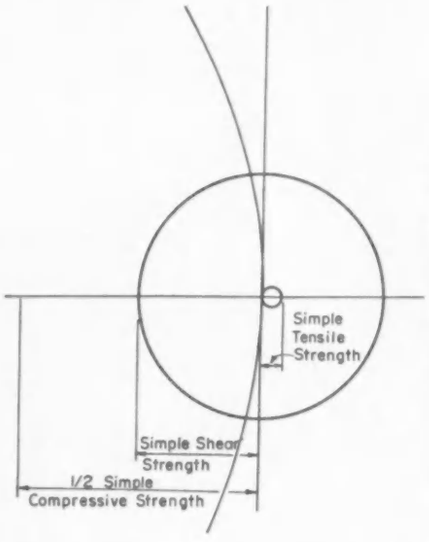


FIGURE 2—Mohr's circles for the strength of sandstone.

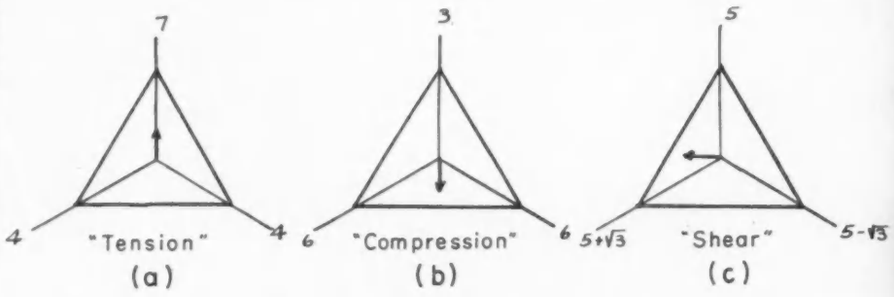


FIGURE 3—Direction of octahedral shear in some simple cases (principle stresses proportional to the numbers give octahedral stresses of equal magnitude in all three cases).

possible combinations of stress which cause failure were drawn, the envelope curve tangent to them would represent the conditions of failure according to his theory.

Thus if two or three circles, representing simple compression, tension and shear, say, can be obtained, the conditions of failure for at least a limited range could be established. Attempts to verify the theory experimentally were, however, unsuccessful (see References 1 and 14). Figure 2 suggests a simple objection to it: for sandstone, the envelope curve cannot be drawn tangent to all three circles.

A similar generalization of the distortion energy theory was proposed by Schleicher[4] and Nadai[2] wherein τ_y is a function of the octahedral normal stress, σ. Unlike Mohr's theory, this takes into account the influence of the intermediate principal stress. This omission had been blamed for the discrepancy between Mohr's theory and experiment. An analysis of the same tests which refute the Mohr theory, however, has shown that they agree little if any better with the Schleicher-Nadai theory.[5]

Now, since we have shown that any state of stress can be resolved into octahedral components, and the criterion of strength has been expressed simply as a function of the only two magnitudes concerned, the only possible explanation of the discrepancy between theory and experiment is that the *direction* of the octahedral shear has a bearing on the question, despite the isotropy of the material.

An explanation of this paradox is suggested by the classic experiment of P. W. Bridgman[6, 7] in which a cylindrical bar is exposed to high pressure on its curved surfaces while its ends protrude from the pressure chamber, so that a state of biaxial compression is created. If the bar is of a brittle material such as glass or high carbon steel, the plane of failure is perpendicular to the axis of the bar, although there is no stress on that plane. If the bar is of ductile steel, necking and ultimate failure occur exactly as in a tension test.

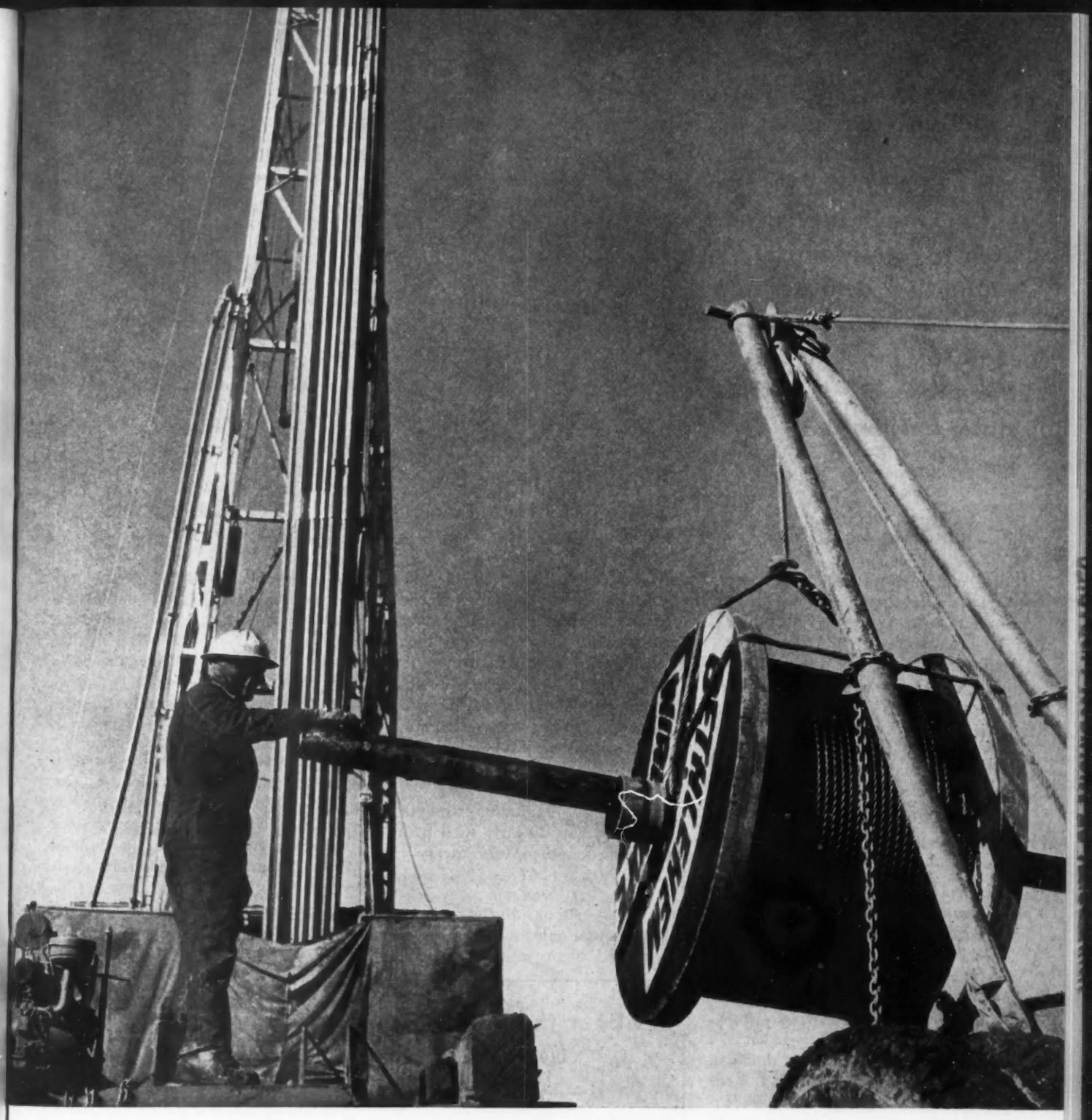
Thus, as Bridgman points out,[8, 9] a state of stress in which two of the principal stresses are equal and algebraically smaller (tension positive) than the third can be considered as an axial tension superposed on a uniform hydrostatic stress; and one in which the third stress is algebraically smaller than the other two can be considered as an axial compression superposed on a hydrostatic stress. Superposition of a hydrostatic stress has no qualitative effect. Figures 2a, b, and c demonstrate that this is true for rock.

It can be shown that two such different states of stress, one "tension" and the other "compression," can give identical magnitudes for the octahedral shear and normal stress, and that the difference between them is that the direction of the octahedral shear is diametrically opposite in the two cases. Pure shear superposed on a hydrostatic stress gives an octahedral shear vector at right angles to those for "tension" and "compression." (See Figure 3.) Other states of stress correspond to other directions.

That the behavior of rock is different in "tension" and "compression" is apparent from Figure 1, so that the direction of the octahedral shear can be seen to have a physical, not merely geometrical, significance. In order to take it into account, consider a representation in which the principal stresses are plotted along the principal axes; then any state of stress can be represented as a point. A point in one octant represents a state of stress in which all principal stresses are compressive; in the opposite octant, all tensile.

Hydrostatic states of stress will fall along an axis through the centers of these two octants. The locus of points representing all limiting states of stress (yielding) for a material is a surface. The maximum shear and distortion energy theories of strength will be found to be represented by a hexagonal prism and a circular cylinder, respectively, along the hydrostatic axis.

In an isometric view looking along this axis, one finds he is looking directly at the octahedral plane and that the octahedral shear is represented on it in a true view, so that these two theories appear as a hexagon and a circle (Figure 4). If τ_y is a function of σ rather than constant, it is possible, as Meldahl[10] showed, to represent the theory by the mapmaker's device of contour lines; so that the Schleicher-Nadai theory, for example, would appear as a series of concentric circles. For any one hydrostatic stress, it would be indistinguish-



Wire Rope at Work—They were at 6100 ft, out in the North Sherman Field, Grayson County, Tex., when this photograph was snapped. Excellent progress had been made, and an ultimate depth of 9100 ft was expected. The rig, which is equipped with a 126-ft portable mast, belongs to Alan Drilling Co., Wichita Falls.

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"Ductile materials appear to fail primarily by sliding in both tension and compression but may fail by cleavage in the presence of hydrostatic tension."

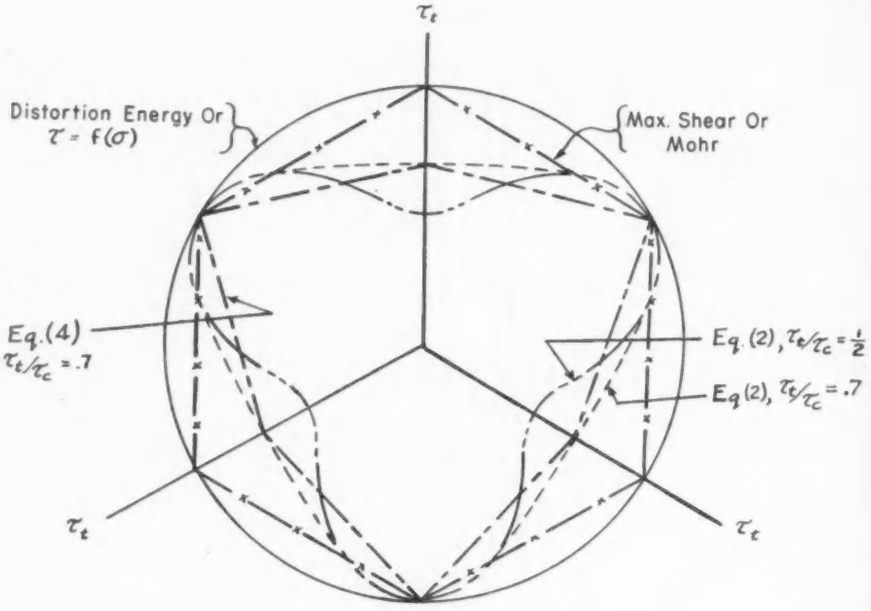

FIGURE 4—Octahedral representation of theories of strength.

able from the distortion energy theory; similarly, the maximum shear and Mohr theories would correspond.

If it be admitted that the limiting octahedral shear in "tension," σ_t, need not be equal in magnitude to the limit in "compression," σ_c, inasmuch as the physical behavior of the material is different in the two cases, it is seen in Figure 4 that isotropy requires only three axes of symmetry. A curve meeting this requirement has the equation

$$\tau_y = \tau_c \sin^2\frac{3\Theta}{2} + \tau_t \cos^2\frac{3\Theta}{2} \qquad (2)$$

where Θ is an angle measured from the projection of a principal axis on the octahedral plane. Two such curves are shown in Fig. 4. When τ_t and τ_c are function of σ, (2) may be regarded as a generalization of the Schleicher-Nadai theory; for when $\tau_t = \tau_c$, equation (2) is that of a circle. All presently existing triaxial test data can be described with the aid of (2). Unfortunately, a strength criterion involving (2) leads to unwieldy analytical expressions.

Inasmuch as there is no test data in that region, the shape of the curve (2) in the 60-degree interval between axes was arbitrarily selected. It may as reasonably be assumed as a straight line, and such a figure is also shown in Figure 4. This figure can be regarded as representing a generalization of the Mohr theory, and is also capable of describing all existing test data.

Since actual test data usually gives curves, this second approach is probably less realistic than the first, but just as the maximum shear theory is useful as an approximation to the distortion energy theory, so may such a generalized Mohr theory be useful.

When applied to problems in which the relative magnitudes of the principal stresses are not known, it may be mathematically clumsy; but in many problems it may lead to relatively simple solutions.

If, as an approximation, strength is assumed to vary linearly with hydrostatic pressure, the Mohr theory can be expressed as

$$\sigma_3 + q\sigma_1 = c \qquad (3)$$

where $\sigma_1 > \sigma_2 > \sigma_3$ (algebraically). It can be shown analogously that the new generalized theory is (with the same approximation) $\sigma_3 + h\sigma_2 + q\sigma_1 = c$ (4) In these equations, σ_1, σ_2, and σ_3 are principal stresses and h, q, and c are experimental constants. It is seen that where the linear Mohr theory requires two types of test to establish a criterion for a given material, equation (4) requires three.

The discussion has been confined to yielding; the next question is, can equation (4) — or (2) — be used as a fracture criterion? In many cases it probably can, but there are additional considerations to be taken into account. Fracture may be either a sliding failure or a cleavage failure. A brittle material tested in simple tension will fracture by cleavage; in compression, by sliding along an inclined plane (compare Figure 1a with 1c).

When sliding occurs on more than one inclined plane, a wedging action may split the specimen, the final separation being a cleavage. Ductile materials appear to fail primarily by sliding in both tension and compression, but may fail by cleavage in the presence of hydrostatic tension. Note that while yielding cannot be caused by a hydrostatic tension, fracture can, for the attractive force between molecules is finite.

One may be led to associate sliding fracture with a limiting octahedral shearing stress or strain, and cleavage fracture with a hydrostatic tension or volumetric strain. Figure 1c, however, shows a cleavage fracture resulting from a state of stress in which all three principal stresses were compressive,

About the Author

A. D. TOPPING graduated from Purdue University in 1940 and holds an M.S. degree from the Missouri School of Mines and the Ph.D. degree in theoretical and applied mechanics from the University of Illinois. Besides his teaching career at Missouri and Purdue he has been employed by Goodyear Aircraft Corporation as engineer specialist handling stress problems arising in connection with research and development problems. He became interested in stresses and strains around bore holes while at the Missouri School of Mines.

"The presence of drilling fluid in a bore hole, for instance, may be ignored in investigations of failure at the rock face, while stresses due to the overburden must be taken into account."

and hydrostatic compression does not cause failure of an isotropic material. Such an association therefore seems to have no basis. Further, cleavage fractures are not readily associated with compressive stresses normal to the plane of cleavage. This suggests a fracture criterion in terms of strains, for the strain normal to the plane of cleavage in Figure 2c was an extension rather than a shortening.

There is another reason for using different types of criteria for yielding and for fracture. Under certain loading conditions, some materials deform without strain-hardening in the plastic range, so that the yield limit stress and the fracture stress have the same value. Under the non-uniform stress distribution which occurs around a bore hole, for example, such a material will not fracture as soon as it yields, as a stress criterion of fracture would imply.

It has already been mentioned that both yielding and fracture must be governed by energy criteria; yet beyond the yield limit a non-strain-hardening material absorbs no more energy, the input energy being dissipated into heat.[15] Unless the energy absorption capacity of the material is a decreasing function of the strain to which it is subjected, fracture must occur coincidentally with yielding, in contradition to experimental observations.

The alternative, on the other hand, is reasonable since a strained material is actually structurally different from the original material. This concept of fracture is illustrated diagrammatically in Figure 5. It is possible and preferable, then, to make the criterion of fracture a function of strain.

The criterion already developed for yielding can be put in general terms as

$$\tau_y = f_1(\sigma, \Theta) \qquad (5)$$

Putting the same criterion in terms of octahedral strains and applying it to fracture gives

$$\gamma_f = f_2(\varepsilon, \Theta) \qquad (6)$$

in which γ_f is the octahedral shear strain at fracture and ε is the volumetric (octahedral normal) strain. Although yielding can only result from shearing strain, while fracture can result from either shearing or volumetric strain, the general form is applicable to either, since the variables may be imagined to describe a geometric surface representing the criterion, and it is immaterial which variable is solved for. Thus (6) can be identical with

$$\varepsilon_f = f_3(\gamma, \Theta) \qquad (7)$$

It is clear, then, that equation (4) can be modified for fracture as follows:

$$\varepsilon_3 + i\varepsilon_2 + j\varepsilon_1 = k \qquad (8)$$

where ε_1, ε_2, and ε_3 are the principal strains and i, j, and k are experimental constants.

In applying yield and fracture criteria to conditions in a bore hole, there is another factor to be considered.

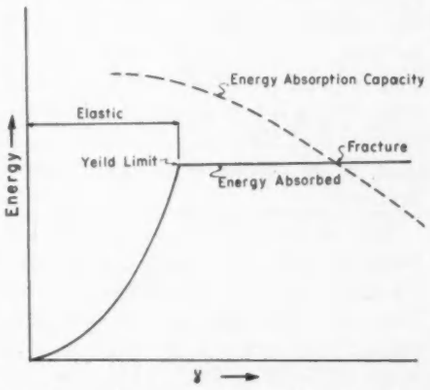

FIGURE 5—Fracture in a non-strain hardening material.

When triaxial tests are made in which the lateral pressure is exerted by fluid having free access to the surface of the specimen, the axial load to cause failure appears to be independent of the lateral pressure.

If the specimen is jacketed (with rubber, say) so that the lateral pressure is still effective but the fluid cannot penetrate the specimen, the lateral pressure has a very important influence. This has been explained by Terzaghi[11] from considerations of the granular structure of rock, which cannot be gone into here. But what is its practical significance? Just this: failure criteria must be based on tests of jacketed specimens, but stresses resulting from fluid pressure may be disregarded.

The presence of drilling fluid in a bore hole, for instance, may be ignored in investigations of failure at the rock face, while stresses due to the overburden must be taken into account. In zones where the fluid does not penetrate, the full fluid pressure must be considered, however, and the behavior of the rock will correspond more closely to that of jacketed specimens. In zones of partial penetration, an effective external pressure must be used which will be less than the actual fluid pressure. There is evidence that when the fluid pressure is sufficiently high, this rule must modified; but in most practical applications, it should serve.

Given the constants, q, h, and c, the depth in a bore hole at which yielding (or fracture where the rock does not yield) occurs can be readily determined from existing elastic solutions (References 12 and 13). To investigate fracture, an elastic-plastic solution is generally necessary. Such a solution has been worked out,[5] but is as yet unpublished.

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—The End

INFORMATION VERSUS COST

By SPENCER F. FINE,
Richfield Oil Corporation,
Ojai, Calif.

PART 1: INFORMATION IN EXPLORATORY DRILLING

"Success is measured by discovering oil, but . . . a dry hole also pays off in information important to the petroleum engineer and geologist."

THE SUCCESS of a wildcat well is measured in terms of whether or not oil is found. Information obtained in most cases while drilling a well which eventually turns out to be dry, cannot be justification for the large cost involved. But the kind and amount of information is nevertheless important to the petroleum engineer and geologist. The engineer, in case of a producer, needs information to locate offsets and to determine reservoir characteristics of the new pool, and the geologist needs it because he is often charged with the responsibility of determining why oil was not found, and possibly to evaluate the area involved based on new information obtained while drilling.

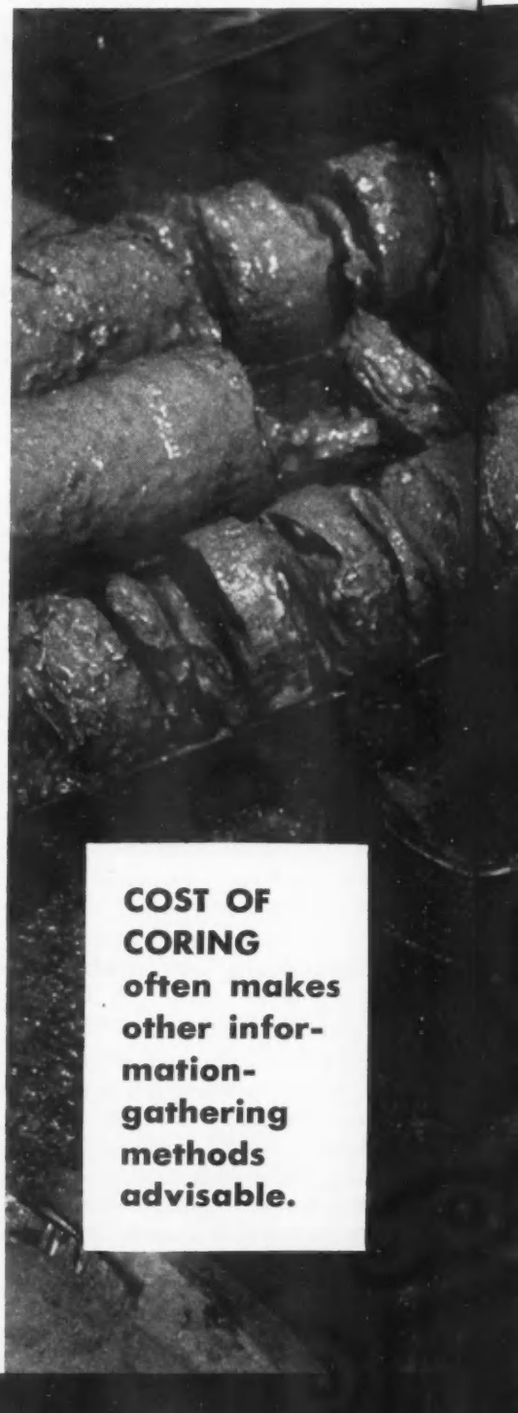
What is the basis for a wildcat well that is not promotional in kind drilled by the average operator? We all know there is no instrument available which will directly indicate the presence of oil underground. Although this is exceedingly fortunate for geologists, it is very expensive for oil companies since about 29 of 30 wildcat wells are destined to be dry holes. Geology has succeeded in indicating the presence of oil better than any other method, but it is an indirect method. All we can do is try to find the structural and stratigraphic locations where oil might be trapped and recommend a test well. So, the location of prospect wells is based on two important items the first being a set of facts and the second, the geologist's interpretation. The quality of the prospect is no better than the factors upon which it is based.

In the attempt to find more oil we have been drilling more holes in recent years and we have been improving the factual information and the personal factor involved in the above equation. That is, we take more cores, run more electric logs, dipmeters, contact logs, etc., than we used to. Also, perhaps the interpretation is better, too, because geologists have better schooling, wider experience, and there are more of them which allows more time to be spent on a particular problem.

Why doesn't the discovery rate increase if this is the case? It is because for every oil field found there is one less to be discovered and the ones that remain are increasingly obscure and more difficult to find. Therefore, increasing amounts of information and better interpretations, or geologists, if you will, are necessary in order to maintain or increase the ratio of discoveries to dry holes.

There are two classes of information geologists try to obtain in drilling a wildcat well. One is simply the information necessary to evaluate potentially productive intervals encountered in the well. The other, wider in scope, is information that will aid in evaluating the area surrounding the well because, if the well is dry, the geologist may be called upon to recommend quitclaim of the lease or drilling another location. Hence, some of the information the geologist desires does not pertain directly to the drilling well, but, of course, the cost of that information is nevertheless charged.

The latter information consists of stratigraphy, dip and strike, and porosity and permeability of salt-water sands. Stratigraphy pertains to age se-



COST OF CORING often makes other information-gathering methods advisable.

quence, lithology and distribution of sedimentary rocks. Most wildcat wells in California have one or more definite sand or fractured-shale objectives, their positions in the geologic column having been determined previously.

Most age determinations and correlations are made by the use of micropaleontology, for which cores, sidewall samples or ditch samples are necessary. There is no universal rule to determine just how much coring or sampling is required. Only experience in the particular area will dictate the minimum amount for adequate control. In areas where electric logs are plentiful, the correlations adequate, and the age determinations previously tied to one of them, a minimum of coring should be necessary.

Most companies now use some method of dip orientation in every wildcat well. This is essential to make an adequate structural interpretation. We must know which way the formation dips in order to locate a new well at a better structural position or, if we have a producer, the strike must be known to locate a duplicate offset well.

Knowledge of the dip is essential to calculate the true thicknesses of formations. Geologists must know both structure and stratigraphy if an accurate geologic interpretation is to be made. We can usually interpret structure if our stratigraphy is accurate or, conversely, we can interpret stratigraphy if we know the structure but, if our information is incomplete or faulty or both, then it is next to impossible to solve the geologic problem. Some way of determining porosities and permeabilities of sands, fractured shales and sandstones is necessary even though these potential reservoir rocks contain only salt water in the wildcat wells.

In conclusion, most of California's oil basins have complex stratigraphic and structural relationships making desirable all the information it is possible to obtain. The geologist's viewpoint is to obtain all the information necessary to minimize the human factor of interpretation. Often this is not consistent with reasonable cost or mechanical conditions but the best compromise has to be made according to the experience of the geologist and petroleum engineer.

PART 2: ANALYSIS OF COST

"Information must be gathered as drilling progresses . . . closely watched and diligently recorded in order to minimize costs and time."

By C. R. BALL, JR.,
Richfield Oil Corporation, Ojai, Calif.

THE FOREGOING tells what information the geologist deems necessary in the drilling of a wildcat hole. Certainly it is the geologists' field to determine what information is required. On the other hand, it is the drilling department's field to actually drill the hole. But, there is a middle ground of operations concerning both sides wherein the desired information is actually obtained during the drilling operations. Usually the coring points, logging depths, and hole-reducing points are indicated by the geologists and carried out by the drilling people. It is in this phase of operations that disagreements most generally arise between the two groups.

The information we must obtain can be broadly classified in three main categories, i.e.: The evaluation of productive possibilities, the stratigraphy of the section penetrated, including the identification and boundaries of rock units and time units, and the dip and strike of the beds penetrated. Each of the tools we use to gather these data gives us information in one or more of these categories.

Electric Log. The electric log[1, 2, 3, 4] is probably the most powerful tool we have for information gathering. It gives excellent boundary definition between beds of different lithology, and pretty good but incomplete information as to the lithology of each bed. For instance, we cannot tell color or hardness from the electric log, except possibly by inference through correlation with another well. Neither are the ages of the beds obtained, except through correlation. In combination with other electrical services, it indicates the presence of oil or gas, and the relative amounts of hydrocarbons, about as well as anything except an actual formation test. In marine beds the presence of porosity and permeability can be inferred from the spontaneous potential curve. The approximate cost of running an electric log,

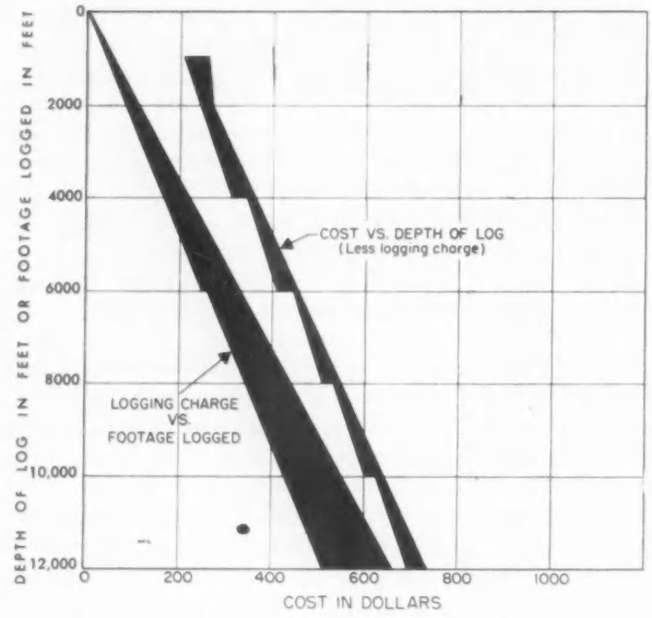


FIGURE 1—Approximate cost of running an electric log, including rig time.

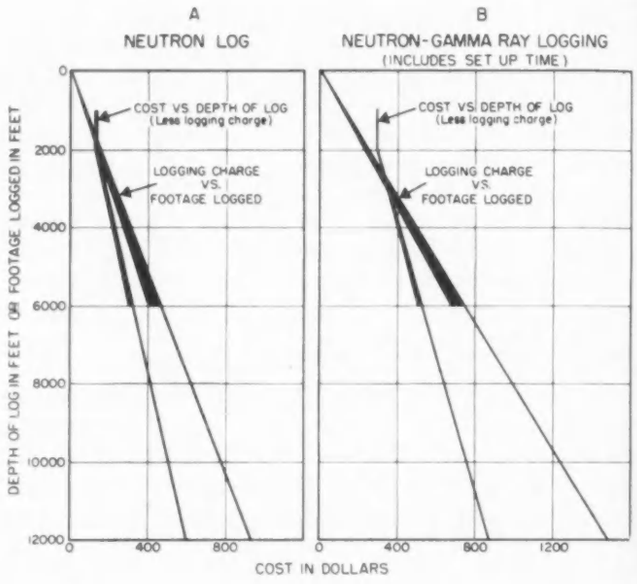


FIGURE 2—Approximate cost as a function of depth and footage logged including rig time. Rig cost: 0-6000 feet $40-$50 per hour; 6000-12,000 feet $50 per hour.

including rig time, is shown in Figure 1.

The selection of the proper device for obtaining resistivity is most important in quantitative evaluation. The laterolog or guard electrode log, and the induction log,[1,5] are devices which can determine true resistivity in many instances where the regular electric log resistivities are not satisfactory for quantitative calculations.

Neutron Log. The neutron log[1,6] records largely the fluid content of the formations. It has recently come into use in quantitative analysis since from it porosity may be calculated. It is especially valuable in very hard, low porosity formation where the contact log is of no quantitative value, and it is unaffected by hole fluid and hence is of great value in quantitative calculations in oil base mud. The neutron log, however, fails to distinguish between oil and water so cannot indicate the presence of oil. It does distinguish between fluids and dry gas, therefore, it is of value in indicating gas sands. The cost of this service is represented in Figure 2, shown in the same manner as the curve for the electric log.

Gamma Ray Log. Gamma ray[6] logging is not generally used in exploratory holes in California. However, it has certain applications which might be mentioned. Gamma ray logging produces a curve which indicates lithology about as well as the electric log, but it is unaffected by fluid content of the formations; hence, is only a correlation curve. It functions in oil base mud or casing as well as in open hole. Its cost is slightly greater than the cost shown in Figure 2 for the neutron log due to the fact that it might be run at slower logging speeds.

Contact Log. The contact log was originally developed to indicate permeable zones by recording the presence of mud cake,[7] and is still used for this purpose. Since then, computation techniques have been developed to calculate, from these curves, the formation resistivity factor and, from this, porosity is estimated.[8]

These two items are basic in quantitative calculation of the oil and gas content of porous beds from electric log data. This tool has removed from the realm of assumption much of the data used in quantitative saturation determinations. Quantitatively, it is limited to formations of low to medium resistivity. In cases where the contact log is limited, however, either the electric log or the neutron curve usually supplies the needed information. The cost of this service is represented by Figure 3.

Ditch Samples. Another powerful tool at our disposal is the careful collection and inspection of drill cuttings or ditch samples. This is a source of information too often overlooked or disparaged. It is data available during the drilling of the well, causing neither shutdown nor slowdown of drilling operations. In these days of better muds and bigger pumps the majority of cuttings in the mud stream should be representative of the formation being drilled.

In many cases, not only the lithology, but also the age of the formation can be determined. The combination of the electric log and cuttings generally gives an excellent record of lithology. The inspection of cuttings with a fluorescent light often indicates the presence of oil. It is of the utmost importance that the field geologist inspect the cuttings often and that a complete written description of the cuttings and preferably also a graphic log of the lithology be compiled as drilling progresses.

Coring. Cores[1,9] are the best source of information for determining lithology and age. If visible reliable bedding is present they are excellent for determining dip. Strike can be obtained, at an additional cost, by polar core orientation.[10] The presence of oil is obvious in a core, distillate shows brilliantly under a fluorescent light, and dry gas can often be detected by a "flash" test of the core barrel as the core head is removed. Oil saturation, as determined by core analysis, is subject to inaccuracies and is valuable only in a comparative way based on experience. Permeability and porosity are obtained more accurately through core analysis than in any other manner. However, the continuous coring of a well would be prohibitively expensive. In order to be

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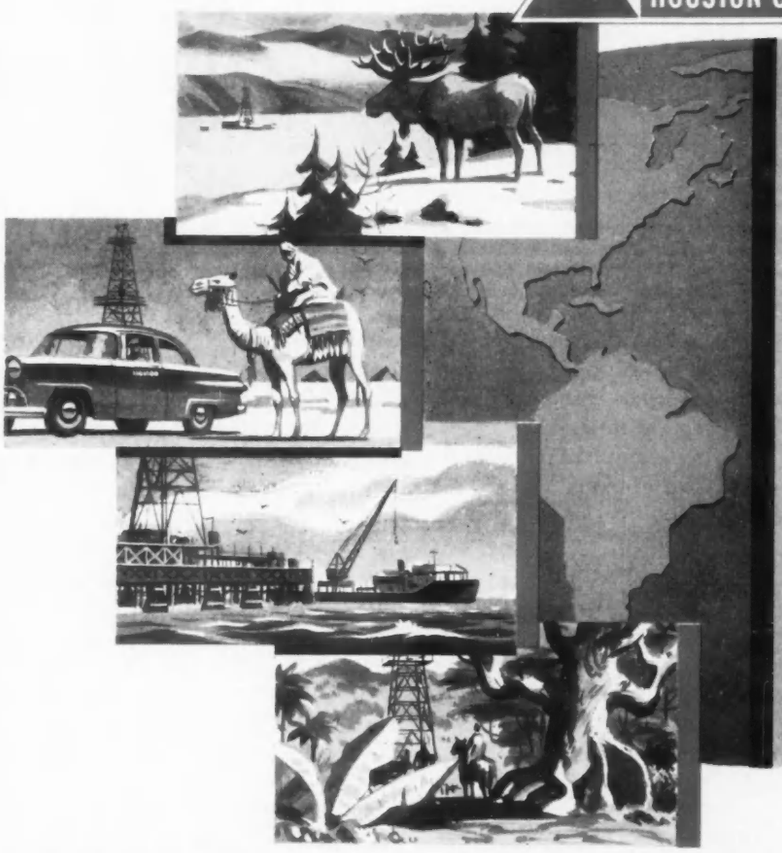

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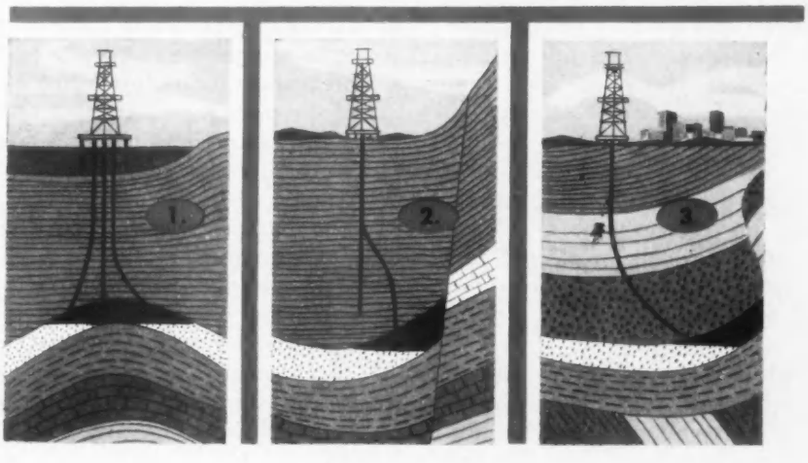

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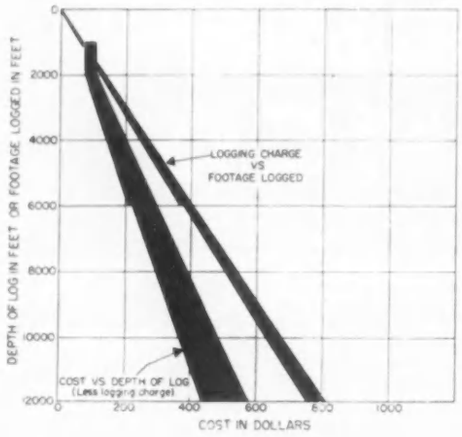

DEPTH OF LOG IN FEET OR FOOTAGE LOGGED IN FEET
LOGGING CHARGE VS FOOTAGE LOGGED
COST VS DEPTH OF LOG (Less logging charge)
COST IN DOLLARS

FIGURE 3—Approximate cost of contact log as a function of depth and footage logged including rig time. Rig cost: 0-6000 feet $40-$50 per hour; 6000-12,000 $50 per hour.

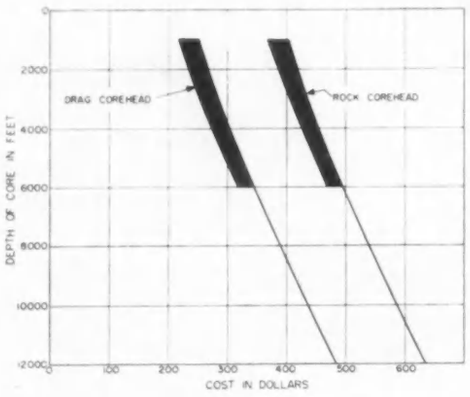


FIGURE 4—Approximate cost of coring as a function of depth of core. Rig cost: 0-6000 feet $40-$50 per hour; 6000-12,000 feet $50 per hour.

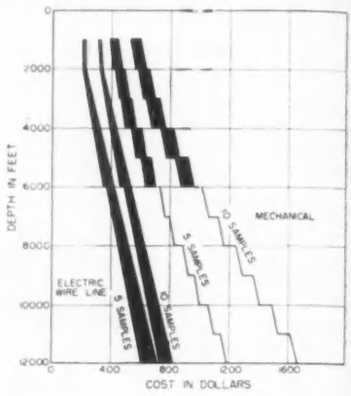


FIGURE 5—Cost of sidewall coring as a function of depth including rig time. Rig cost: 0-6000 feet $40-$50 per hour; 6000-12,000 feet $50 per hour.

used most effectively, cores must be taken sparingly as indicated by information obtained through rate of penetration and cuttings analysis. Figure 4 shows the approximate cost of an 8½-inch core at any depth.

Sidewall Samples. Sidewall samples[1,9] obtain much of the same information as cores, but with these differences: The sample obtained is small, and although usually adequate for core analysis and micropaleontological inspection, is not as reliable as a core. Cores are obtained as drilling progresses, allowing hole reducing and testing on bottom if worthwhile shows are obtained, whereas sidewall samples are obtained after the hole is made. Cores give us dip, and, at an additional cost, strike. Sidewalls give neither. The costs of obtaining sidewall cores are shown in Figure 5.

Rate of Penetration. Rate of penetration[11,12] is another source of information that is acquired as the hole is being drilled. It, too, is too often overlooked or disparaged. These data can be gathered by requiring the driller to keep a record, either depth each hour or time for each foot or five feet drilled.

Dipmeter or Dip Log. There are at present several electric wire line tools on the market for recording formation dips. Basically they measure formation resistivity, spontaneous potential, or bore hole rugosity at equally-spaced points on the circumference of the hole. Figure 6 shows cost depth for these various services.

The curve on the left is for the regular dipmeter which has been available for several years.[13] This curve is for three levels of dip orientation. Additional levels cost about $62 to $65 including rig time. The curves on the right represent the comparatively recent continuous type dipmeters.

Oriented Cores. Presently available in California are two devices for taking oriented cores. One is a punch-tube device which is run in place of the inner barrel in a regular wire-line core barrel. A few inches of core are punched on bottom concurrently marking a "lowball" indicator attached to the core tube. The other device available uses a conventional type core head on a non-magnetic core barrel and has a rather intricate orientation device. The price structures for these services are somewhat complicated but a rough estimate of from $100 to $350 per core, plus the cost of the core as shown previously, will suffice. This service is particularly valuable in very steep beds, or high angle holes in which the electric dipmeter is often incapable of determining dip or strike.

Gas Detector. A method of recognizing oil or gas shows as they are penetrated is the combustible gas detector. It is especially valuable in evaluating drilling "breaks" as they occur.

Formation Testing. Formation testing,[1] or drill stem testing, is the only way of actually determining the rate of which a formation will produce fluid and the nature of the fluid it will produce without setting casing. It is presently general practice in California to test any zone in a strictly wildcat well which is not pretty well condemned by logs, cores, and other information. The cost of formation testing, including hole conditioning and making up tools, is shown in Figure 7.

It is desirable to test "on the way in," that is, to test a formation as soon as it is penetrated, for at least three reasons:

1. The sooner the zone is tested the less damage will have been done to the productivity of the formation by the drilling fluid.
2. Methods of testing on the way out are costly.
3. The longer the formation to be tested is exposed to the mud column and to passing drill pipe through it, the more liable it is to be washed-out or "keyseated," preventing successful sealing off of the packer.

It is also desirable to test in a "rat hole," or reduced-size hole, for at least two reasons:

1. The packer, once it has been pulled from the rat hole after the test, has ample clearance in the full gage hole above to minimize sticking and swabbing.
2. Mechanically, a packer has a better chance of holding in a smaller hole than a large one.

From these two basic desires it has been the practice of many operators to explore long intervals in reduced hole as much as several thousand feet generally with the proviso in the program to "open hole as dictated by good drilling practice."

The tools mentioned previously which give information as the hole is being drilled, are drill cuttings inspection, rate of penetration indicator and

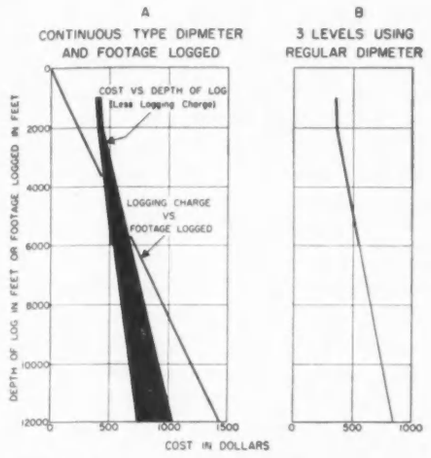

A
CONTINUOUS TYPE DIPMETER AND FOOTAGE LOGGED
B
3 LEVELS USING REGULAR DIPMETER
COST VS. DEPTH OF LOG (Less Logging Charge)
LOGGING CHARGE VS. FOOTAGE LOGGED
DEPTH OF LOG IN FEET OR FOOTAGE LOGGED IN FEET
COST IN DOLLARS

FIGURE 6—Approximate cost as a function of depth including rig time. Rig cost: 0-6000 feet $40-$50 per hour; 6000-12,000 feet $50 per hour.

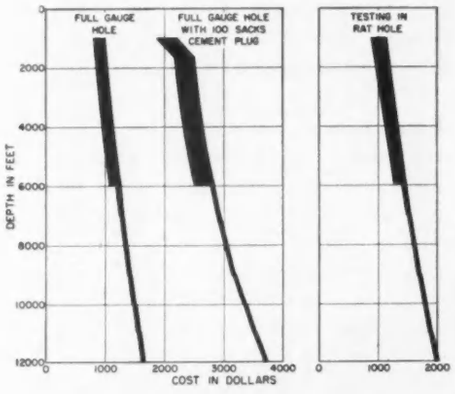


FIGURE 7—Approximate cost of 100 feet of open hole formation test as a function of depth including rig time. Rig cost: 0-6000 feet $40-$50 per hour; 6000-12,000 feet $50 per hour.

combustible gas detector. To evaluate the cost of these services versus rat holing, Figure 8 has been prepared.

In the column showing the cost of these devices there is included $25.00 per day for a geologist since the intelligent use of these services would require the close attention of a geologist.

The column entitled "mud logging" shows the cost of a commercial mud logging trailer for the time required to drill this same interval.

It is presumed that upon evidence of shows by the services mentioned, a core would be taken in reduced hole. This should provide enough information to decide upon penetrating enough deeper to log and possibly test, or drilling ahead full gage. Yet, to be practical, it must be realized that some shows will be penetrated too far with the full gage bit before they are detected to allow testing in rat hole. The disadvantages of testing in full gage hole have been greatly reduced in the past year or two due to the development of improved sidewall packers.

For those intervals in which the open hole test fails the first run, the interval is usually retested with the packers set at slightly different depths or, if only one packer has been used in the first test, perhaps two may be run for the second. If this fails and the test is in rat hole, the hole can be opened to a larger size and retested. This is one advantage of testing in a rat hole but as can be seen from the figures cited above, this advantage applies to only a very small percent of tests. For those few intervals in which open hole testing fails conclusively the test will usually be deferred until total depth has been reached and the intervals tested on the way out, for two reasons:

1. Other methods of testing usually involve restricting the size of the borehole by stub liner or casing.
2. Other methods of testing are quite costly. If commercial production is obtained deeper, the test can be deferred and attempted in a subsequent development well.

A method of testing either on "the way in" or on "the way out" involves those formations which are drilled through without being detected and are found up the hole by logging or sidewall sampling at a lower depth. These zones can be tested by using the straddle tester.

For those intervals in which all of the open hole testing methods fail there are these methods of testing on the way out:

Plug and Test in Open Hole. This method involves the placing of a cement plug below the interval to be tested both to isolate the interval from the hole below and to form a button on which to set the test tail. Otherwise, the procedure is the same as for regular open-hole testing. The method has all the disadvantages previously listed for testing on the way out, plus a few all its own. The cement plug and/or the mud-soaked formation around it are sometimes soft and allow the test tail to slip down the hole, minimizing chances of a successful test, and increasing the chances of sticking the tester.

The plug is also likely to leak fluid from below, completely confusing the results of the test. There is no way to tell whether the fluid recovered in the test comes from above or below the cement plug. The price of this type of testing is also shown in Figure 7.

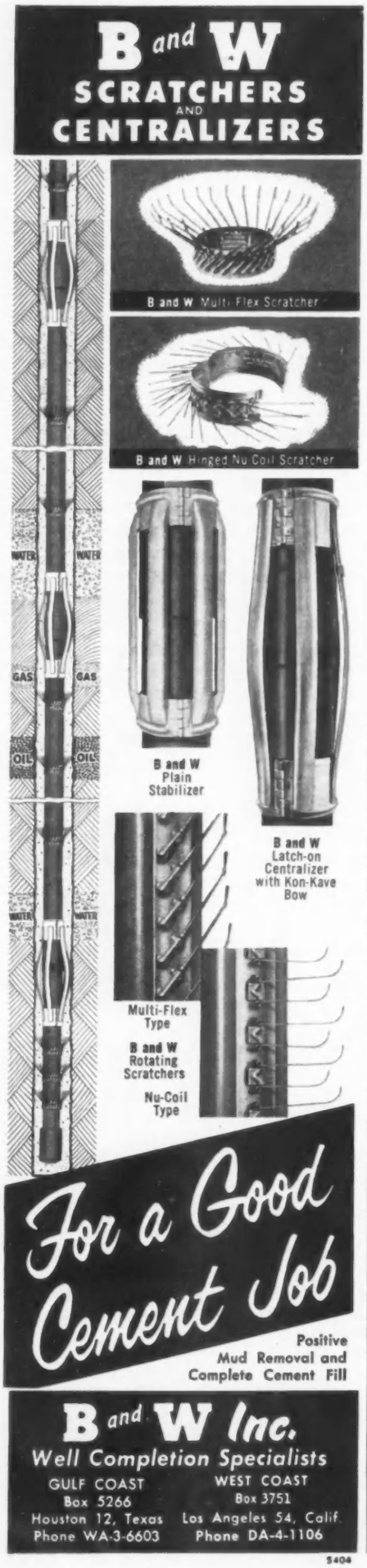
Plug and Test in Stub Liner. This consists of cementing a joint or two of casing above the interval to be tested and setting the packer in this casing. This eliminates two of the disadvantages of the method above, in that the packer seat is very good and a hookwall packer may be used eliminating the hazard of setting test tail on a plug. It is about equal in price to the method above, except that cost of casing must be added.

Plug, Redrill and Test in Open Hole. This method eliminates all of the disadvantages stated for the previous methods, except cost. It enables testing in a clean, fresh borehole with a solid bottom. It costs as much as the methods above, plus the cost of sidetracking and making new hole. This cost is subject to so many variables that no general cost curve can be constructed but should be of the order of several thousand dollars.

Cement Casing. This, of course, amounts to putting the well on production. Again, so many variables affect the cost that no general curve can be drawn. When there are several zones to be tested, the price per zone may be somewhat less than for one zone, but in this case we incur the cost of perforating, a healthy sum, and probably a few squeeze jobs. Before leaving a zone untested due to this

FIGURE 8—The Cost of 1000 Feet of Rat Hole vs. 1000 Feet Full Gage and Information Tools Shown

Example		8½ Inch Rat Hole Cost	10⅝ Inch Full Gage Hole	
			Drill Cuttings Rate of Penetration Gas Indicator Cost	Mud Logging Cost
10⅝ Inch Bit—200 Ft. at 15 Ft./Hr.	5,000′— 6,000′	$ 950	$190	$ 530
8½ Inch Bit—130 Ft. at 14 Ft./Hr.	11,000′—12,000′	1,460	225	610
10⅝ Inch Bit— 70 Ft. at 5 Ft./Hr.	5,000′— 6,000′	7,760	555	1,580
8½ Inch Bit— 45 Ft. at 3 Ft./Hr.	11,000′—12,000′	9,110	640	1,810



cost, however, this question should be considered: Is there sufficient doubt of the productive ability of this (or these) interval (s) to cause the drilling of another well at a later date?

Conclusions. In order to drill exploratory holes in the most economical manner the fullest use must be made of those information gathering techniques which obtain information as drilling progresses, causing neither slowdown nor shutdown of drilling operations. This information must be closely watched and diligently recorded by the geologist in order to minimize the use of more expensive and more time-consuming information tools.

The practice of exploring in long rat hole intervals appears in analysis to be costly and time consuming. All operations which increase drilling time and the number of round trips increase drilling hazards as well as direct costs. When problems of hole sloughing are likely to occur, the geological information program should be geared to those drilling techniques which allow the most rapid and efficient penetration to the total depth of the well.

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ACKNOWLEDGMENT

This article is a digest of a paper presented at the Spring Meeting of the Pacific Coast District, Division of Production, API, Los Angeles.

New Cement Blend

Continued from Page 102

described. Their compositions may be summarized as follows:

Component	Percent in 20% DE	Percent in 40% DE
Cement	100	100
DE	20	40
Bentonite	2	2
CMHEC	1.0	1.5
Sodium silicate	Variable	Variable
Water	Variable	Variable

The function of each of the special ingredients, pertinent factors pertaining to development and the properties of the slurries will be discussed. The results will then be summarized in terms of practical applications.

Function of the Diatomaceous Earth: Any material used to effect density reduction must either have a density appreciably lower than cement (d = about 3.17 g/cc) or allow more water to be added. The diatomaceous earth (DE) which is admixed with the cement has a density of 2.07 g/cc so that some decrease in slurry density results from the lower density of the DE compared with cement.

TABLE 3
Typical Effect of Bentonite on the Properties of 11 Lb/Gal Slurries Prepared With the 40 Percent DE System

Bentonite, Percent	Thickening Time at 180 F, Hours:Minutes	Compressive Strength When Cured 24 Hours at 160 F, psi
0	5:41	534
1	5:28	643
2	4:53	661
3	....	665
4	5:01	637

However, the major function is to permit addition of more water. Minimum and maximum water contents for simple mixtures of DE and cement were determined to establish the operable density range of each mixture. For slurries admixed with 0, 10, 20 and 40 percent DE, the ranges for percentage water and the corresponding slurry densities were found to be:

DE, Percent	Water, Min.	Percent Max.	Slurry Density, At Max. Water	lb./gal. At Min. Water
0	40	63	14.4	16.3
10	80	110	12.5	13.6
20	110	>140	<11.95	12.7
40	170	>280	<10.6	11.7

The densities of the slurries determined at atmospheric pressure are about 0.1 pounds per gallon less than the computed value. This is attributed to a small amount of air occluded in the slurry during mixing. The densities of slurries set under pressure agree closely with computed values.

Hence, unlike some types of cement, the slurry density or volume as measured at the surface of the well need not be corrected for pressure.

From the above tabulation it is evident that the permissible variation or the range for percentage water increases with increase in percentage DE admixed with the cement. Other ingredients—bentonite, CMHEC and silicate—of the low water-loss systems do not materially affect the water-to-cement ratio. For the two systems which have been developed, the recommended water content is approximately midway between the maximum and minimum value, and the range is conservatively set pending more complete results on the properties of the slurry as a function of percentage water.

Figure 3 may be used as a guide to determine the slurry density for the systems described in this report.

Function of Bentonite: While DE is the principal bulking agent, it was found desirable to admix 2 percent bentonite with the cement. As shown in Table 3, the early strength developed by the cement is at a maximum with bentonite concentrations of 2 to 3 percent. Concentrations of bentonite higher than 4 percent cause marked reduction in the strength. The data in Table 3 show that bentonite has no pronounced effect on the thickening time.

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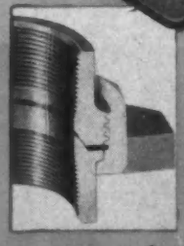

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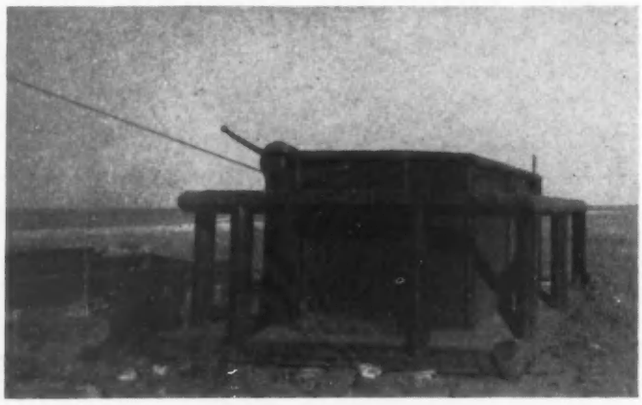
Rack Insures Rotary Hose Protection



Safe location-to-location handling of the rotary hose will pay dividends in longer, more dependable service life. When the hose is properly rigged in a derrick, there is little danger of damage from friction, cuts or blows; however, on a rig move, haphazard handling can reduce performance history.

Often, the operator will build a rack for carrying just the rotary hose. However, by designing a combination hose and junk rack, equipment handled on rig moves can be reduced.

The illustrated combination hose rack-junk bin is a welded structure consisting of 6-inch casing, 3-inch tubing and ¼-inch floor plating. The skid base is seven feet wide and ten feet long, constructed of 6-inch casing, cross-reinforced with the same size pipe and floored with steel plating. The skid ends are angled to speed loading.

The four-foot rail, which extends around two sides and one end, is also fabricated of 6-inch casing with each supporting post cut to fit the skid and upper rail curvature.

The junk box is seven feet long and five feet wide. Corners are built at 45 degree angles to reduce the possibility of hose cut resulting from sharp edges. The vertical 3-inch junk bin supports are stationed on the outside as an additional hose protective measure.

Bin construction consists of first welding the 5-foot, 3-inch tubing vertical supports to the floor plate and, where possible, to the 6-inch pipe spreaders. Sections of 3-inch tubing are cut to fit in between the vertical posts to form a rail around the top. At this point, sections of plate steel are cut and welded to the inside of the bin frame work.

Utility Ramp Can Be Made From Scrap Drill Pipe

Retired drill pipe can be used to advantage in the construction of either pipe or utility ramps connected to the derrick substructure. Reduced support requirements, rigging ease and permanence are featured in the pictured ramp. However, if this type unit is to be used for handling pipe, protectors should be installed to eliminate thread damage while traveling over a steel surface.

The over-all length of the pictured unit will depend upon height of the derrick substructure, while the width can vary from four to six feet, depending upon derrick floor width.

Step number one in construction of this unit is determining the correct angle to be employed in connecting drill pipe members to the shoe plate. By placing a long rod or board over the area where the finished ramp will be stationed, angle measurements between the pipe rack walkway or loading platform (in case of a utility ramp on the standpipe side of the derrick) will reflect this needed structural detail.

The base plate is cut from ½ to ¾-inch steel plate with the edge, looking toward the pipe rack walkway, beveled to eliminate possibility of tool joints hanging in movement from the walkway up the ramp.

After drill pipe lengths are cut to coincide with the base plate angle, a practical spacing pattern is determined. The above ramp employs a spacing plan of approximately one inch between each pipe section except for the rack center which has a three-inch gap. The larger gap is the result of cutting the shoe and top plate so the ramp can be moved in two sections. However, in some cases when it may be of advantage to construct the entire rack as one unit, the spacing pattern can be uniform.

Design of the top anchor plates will vary depending upon the needs of the operator. For example, pipe ends can be heated and sledged flat, then welded to a perforated plate which will bolt directly to the derrick floor. Or an angle plate can be so designed that it will bolt to the uppermost substructure beam with the ramp end being on the same level as the derrick floor. In this case, the flat pipe ends are welded to the upper anchor plate, possibly with a larger space between joints to facilitate anchorage to the substructure beam.

Stability is assured by welding heavy gage steel plate or a short section of drill pipe across the width of the ramp.

Dual-Purpose Rack Solves Transportation Problems

Gravity flow fuel systems often present transportation problems since special, independent structures are required for tank elevation. Generally, the substructure cannot be attached permanently to the tank because of highway and bridge restrictions. To overcome this problem, and to reduce movable rig equipment by one piece, one contractor designed a junk rack of proper dimension to support the fuel tank at a workable level.

Dimensions of the junk rack support are dependent upon measurements of the fuel tank. However, since the average tank is similiar to the illustrated unit, the resulting junk rack will be of adequate size to accommodate miscellaneous equipment during a rig move.

In some instances, it will be impractical to build a rack of sufficient height and with sides at a desirable load level to elevate the fuel tank to proper operating position. Then, on high structure rigs, it may become necessary to use additional supports to elevate the tank to an operating level.

The above unit, incorporating the inverted junk rack, is given additional height by two saw-horse type elevators. In some cases, it will be possible to employ two stacked junk or pipe carriers for the desired elevation rather than depending upon the horse type supporting units.

Install Auxiliary Trough To Aid Mud Distribution

A majority of mud tank systems are so designed that fluid can flow from the uppermost level of the settling tank directly into the suction tank. With this arrangement, installation of an auxiliary distributing trough is simple.

The illustrated trough can be constructed of either lumber or plate steel; the latter being preferred in steel tanks. In dimension, the trough should be twenty inches to two feet wide, with a one-foot sideboard. The trough end near the pump suctions remains open and down approximately one-half the distance of the trough, an 18-inch door is cut through the side board. Each opening is rigged with retainers for slide type doors or

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gates. Although this feature is not essential, it is convenient if the system volume reaches a high level when the auxiliary trough is not in use.

The plate steel trough is welded to the tank side, whereas the wooden trough must be attached to an angle iron support bolted or welded to the tank side. Angle iron bracing is extended from the trough base to the tank side.

In operation, the lower flowline between the settling and suction pits is closed while the gate on the upper line is opened. Then, with the auxiliary trough at the mouth of the upper flowline, mud circulates through the trough and drops into the tank through the distributing doors.

An extension of this same system through the settling tank to the shale tank, with the auxiliary trough free of openings, will create a by-pass system which will offer certain advantages when minimum fluid volumes are required or if radical system treatment makes it desirable to condition minimum quantities of fluid simultaneously.

Pipe Cap Safeguards Relief Valve

Serious accidents have occurred as a result of steel fragments flying from the severed control element in nail-governed pressure control valves. To eliminate this hazard peculiar to the popular nail-type valve, one operator rigged the illustrated bonnet which swings over the valve and restricts the travel of metal fragments in case of valve release.

This protective device is shaped from a 4-inch casing section, capped

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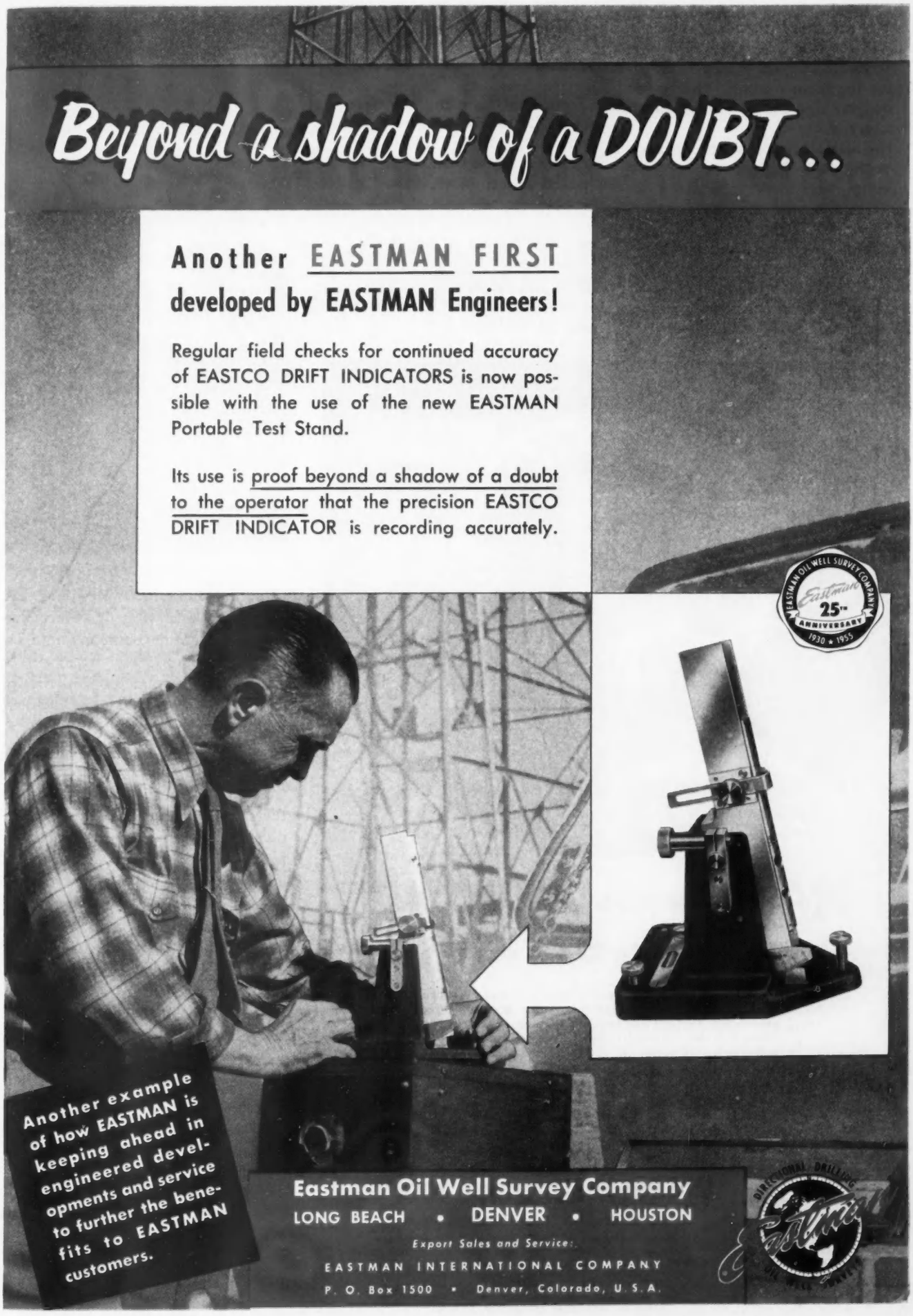

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on one end and loop-hinged on a pin welded atop the relief line.

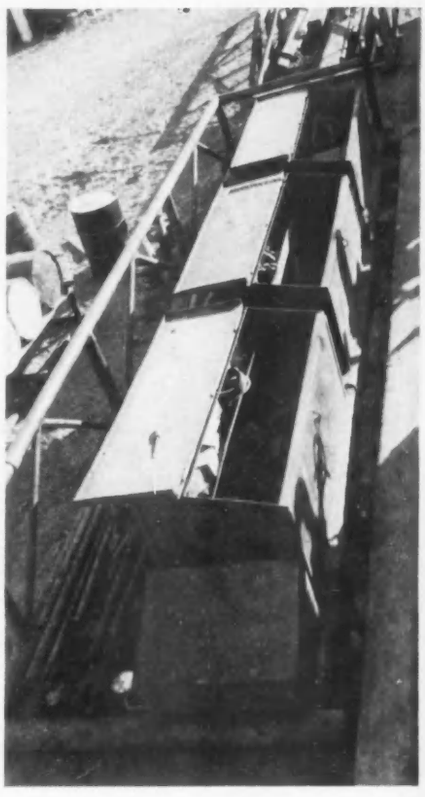
Access to the valve is possible by lifting the bonnet guard. The bonnet is dropped over the valve when operations are resumed.

The field-fabricated protective hood generally used with nail-governed pressure relief valves consists of a collar welded around the upper portion of the valve head, and a bull plug made-up therein; thus covering the relief valve nail element. However, the above unit is easier to install and does not present the problem of frozen or mud-tight threaded connections.

Rig Pipe Carrying Rack To Include Tool Boxes

Equipment handling during a rig move will be reduced by attaching location tool boxes to the carrying rack designed for small, lightweight pipe. As shown above, this will allow the operator to move the pipe rack and three tool boxes simultaneously instead of having to handle four individual units.

The dimensions of the rack are five feet by twenty feet. The skid base is made of 4½-inch drill pipe runners



while the end sections are 6-inch casing. For greater strength, the runners are welded inside doors cut into the two 6-inch casing end sections. The ends extend beyond the skid runners so that it is convenient for handling with a winch line.

The skid base is given further reinforcement by six cross supports, cut from 4½-inch drill pipe, welded to the skid runners. These reinforcing dividers also provide an anchoring foundation for the three tool boxes. The boxes can either be bolted or welded to the cross members of the skid base.

The rack is closed on one side and end with 4½-inch drill pipe rails attached to 3-foot posts and diagonally braced with 2-inch tubing.

On rig moves, the rack is designed to carry a quantity of 2 and 3-inch pipe lengths plus the contents of the tool boxes.

The combination rack utility can be increased by welding a nipple with connecting valve and union assembly on each end of the base so that the skid runners become a part of the water or fuel system. This method will save some rig-up time and, in all, the practice will place more unity in rig-up method.

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Permanent-Type Well Completions

What Progress Has Been Made?

By **T. A. HUBER and G. H. TAUSCH,** Humble Oil & Refining Company, Houston

Many new tools and new techniques have been introduced. With the solutions of the problems confronting this type of operation, it becomes apparent that the use of small through-the-tubing tool will permit a cost reduction and still allow better well control.

Here is an up-to-the-minute discussion of the advancements in through-the-tubing workover operations.

Approximately 2000 wells in the Gulf Coast of Texas and Louisiana have been completed with the bottom of the tubing above a number of producing intervals to permit future recompletion utilizing through-the-tubing tools run on a small wire line without a rig. As the permanent-type well-completion technique has increased in use and has been accepted as a routine method of recompleting wells, new tools and new techniques have been produced in ever-increasing abundance. Some of the new tools and techniques are described here.

Techniques and equipment have been developed that permit logging, cementing, perforating, removing sand and set cement, production stimulating, and the exclusion of sand below the tubing without removing the tubing. These techniques have been used to depths greater than 11,500 feet. Over a dozen abnormal-pressure wells have now been recompleted without killing the well with mud.

Equipment now is being field-tested which unifies all services and equipment to bring about a reduction of surface equipment, manpower, and time necessary to perform well recompletions by the permanent-type method.

THROUGH-THE-TUBING WORKOVER OPERATIONS

Cementing operations. It has been gratifying to observe that results of low-pressure squeeze-cementing operations in the field have substantiated predictions based on laboratory tests. The use of low pressures and small cement volumes, in addition to the avoidance of formation fracturing, has been observed in hundreds of field jobs in the last two years. Most of these jobs were dry-tested successfully. However, this operation has been virtually eliminated on plug-back jobs and on some other cement jobs where experience dictates. At present, surface squeeze pressures vary from 400 to 1800 pounds per square inch with a very slight downward trend apparent in some areas. It has been the rule to use squeeze pressures in excess of the probable reverse-circulating pressures, but the trend to less cement and lighter cements will permit much lower surface squeeze pressures. Initially about 15 barrels of cement slurry were mixed per squeeze job; however, only 8 to 12 barrels of slurry are being mixed in most areas at this time.

Normally a 12 percent bentonitic cement has a filtration rate of approximately 90 to 120 cc in 30 minutes API when clean, fresh mix water is used. However, the use of brackish water in some areas resulted in a cement slurry having a water loss of approximately double this value. This excessive filtration rate resulted in a cement node buildup inside the casing which restricted the use of the tubing-type perforator. It was found that by increasing the bentonite content of the modified cement to 25 percent, the water loss of the resultant slurry could be halved; and this use of 25 percent bentonitic cement has been adopted in areas having poor mix water and small casing or liners.

When using 25 percent bentonitic cement, it is desirable to increase the calcium lignosulfonate used as a retarding agent. The following is the percentage of calcium lignosulfonate to cement used for 25 percent bentonitic cement.

Well Temperatures, Deg. F.	Percent Calcium Lignosulfonate
Up to 145	1.2
145 - 180	1.4
180 - 220	1.6
220 and above	Make laboratory test

Prior to the use of 25 percent bentonitic cement in field operations, a laboratory investigation was made of the effect of cement filtration rates, squeeze pressures, and formation permeability upon the node buildup or filter-cake buildup that extends into the casing. To perform these tests, Berea sandstone cores were cemented inside a small container made of 4½-inch drill pipe with a plate welded on one end of the drill pipe. Holes were drilled through the upper plate and core to simulate perforation holes, and an upper chamber was threaded to this core holder as a reservoir chamber for cement and nitrogen.

This complete assembly is shown in Figure 1, with a side view of the

filter-cake buildup. Three cements with different filtration rates were squeezed into cores of equal permeability with 1300-psi nitrogen pressure, and the node buildup from the plate on the core holder was measured every 10 minutes until the squeeze pressure had been maintained for 40 minutes.

Figure 2 shows the relationship between node buildup and filtration rate and it illustrates the smaller node buildup with 25 percent bentonitic cement vs. 12 percent bentonitic cement and vs. 12 percent bentonitic cement mixed with salt water to increase the filtration rate. Once it was ascertained that the use of 25 percent bentonitic cement resulted in small node buildup, additional tests were performed by squeezing this cement into cores of the same permeability while varying the squeeze pressures from 100 psi to 1300 psi. There was no appreciable difference in filter-cake buildup with variations in squeeze pressures, as shown in Figure 3.

As a final series of tests, using this same cement and 1300 pound squeeze pressure, cores of varying permeabilities were used to simulate the perforated formation; and there seemed to be little correlation between filter-cake buildup and permeability of the formation. The permeability of the formation did affect the time necessary to completely fill the perforation hole with cement; but after the hole had been completely filled with deposited filter cake, the permeability of the deposited filter cake then became the controlling factor in the deposition of cement within the casing.

It was interesting to note that a perforation hole could be completely filled with cement filter cake to the inside of the casing in a very short period of time, varying from a few seconds to a little over 2 minutes, as illustrated in Figure 4.

This same test apparatus became a convenient means of applying back pressure on the core in an effort to remove the cement deposition by pressure differential into the well bore. An effort was made during these tests to determine the minimum waiting-on-cement time and still satisfactorily withstand a 1000 psi pressure differential. Eight to 12 hours setting time was satisfactory with 12 percent bentonitic cement, but it was often necessary to wait 24 hours before 25 percent bentonitic cement would satisfactorily hold 1000 psi.

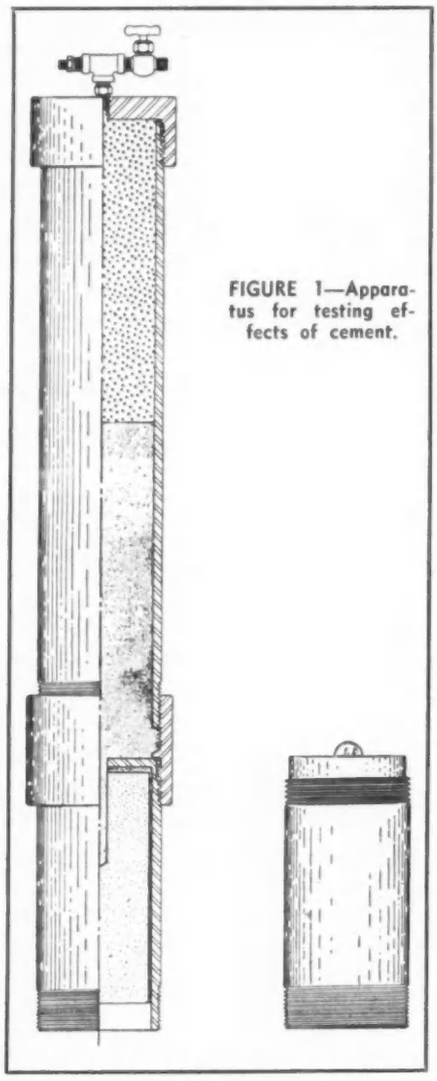


FIGURE 1—Apparatus for testing effects of cement.

In an effort to obtain stronger cement in the least possible time and to reduce the waiting-on-cement time, experiments were then conducted on various materials that might be flushed through the deposited cement prior to its initial set and while the deposited cake still had a slight permeability. It was found that 24-hour strength could be obtained with 12 percent bentonitic cement in approximately 3 hours and with 25 percent bentonitic cement in approximately 6 hours by allowing 20 percent calcium chloride water to filter through the deposited cement under 100 psi pressure differential.

There was some fear that the use of calcium chloride might shrink the bentonitic clay present in the cement, leaving resultant cracks in the deposited cake. However, this did not occur on the majority of tests.

The use of calcium chloride as a means of flash setting the deposited cement was then tried in the field under actual well conditions and dry tests were obtained. In an effort to obtain a cement containing less bentonite but having low water loss and being capable of taking a flash set more rapidly, field trials were conducted with an oil-emulsion cement containing kerosene or diesel oil emulsified with water using calcium lignosulfonate, portland cement, and 2 percent bentonite. It was found that this new cement had a filtration rate varying from 40 cc to 75 cc in 30 minutes API, depending upon the method of mixing, and 24-hour strength could be obtained in 1½ hours when calcium chloride water was filtered through the deposited filter cake.

In field operations it has been found that a well originally perforated in mud or killed with mud generally will not dry test satisfactorily unless a cement plug covers the interval of perforations. This is true because cement will not be deposited in the perforations plugged with mud and these mud plugs must be removed by pressure differential into the well bore.

Indications are that the second squeeze-cement job may be performed sooner when using this new cement and calcium chloride water as a means of obtaining high initial strength. It was noted during field operations that the new cement not only had a lower water-loss filtration but seemed to have a better flow characteristic while pumping and could be reversed from the well with a very low pressure.

At present service companies are set up in most areas to do a satisfactory job of mixing small batches of modified cement. The use of a small tank with a paddle-wheel mixer or with a whirling hydraulic mixer has assured the correct water-to-cement ratio and complete homogeneity of the slurry. Field work had indicated that the dry ingredients in modified cement do not have to be premixed but can be used in the sack form if the calcium lignosulfonate is added to the water prior to the addition of bentonite and cement.

It has been found, however, that

Permanent-Type Well Completions

better gel characteristics are obtained if the cement and bentonite are added simultaneously even though not perfectly blended. This use of cement in the sack form has been of value when performing permanent-type well-completion operations from small barges in water locations where the use of large bulk-cement trucks might be prohibitive.

During the initial trials of low-pressure squeeze cementing in limestone formations in the East Texas area, cement was found too high in the casing and this could only be attributed to cement backflow. It was reasoned that difficulty would be experienced in dehydrating cement in the fractures of relatively impermeable limestone formations and that the cement in the fractures must in many cases take an initial set in slurry form.

To accomplish this operation, it became a practice to hold back pressure on the formation while removing the excess cement and the tubing extension. This successfully prevented cement backflow in the later permanent-completion jobs in this area. Some areas still adhere to this practice of maintaining surface pressure on squeeze jobs performed on sandstone as well as limestone formations.

Finding cement too high in the casing did create one interesting problem—a means of removing this cement without a rig. To accomplish this operation, steel tubing extension, containing steel telescoping joints at the lower extremity, was used to pump inhibited mud acid against the cement in a swirling fashion. It was found that 500 gallons of mud acid would remove 25 to 30 feet of set cement in 5½-inch casing.

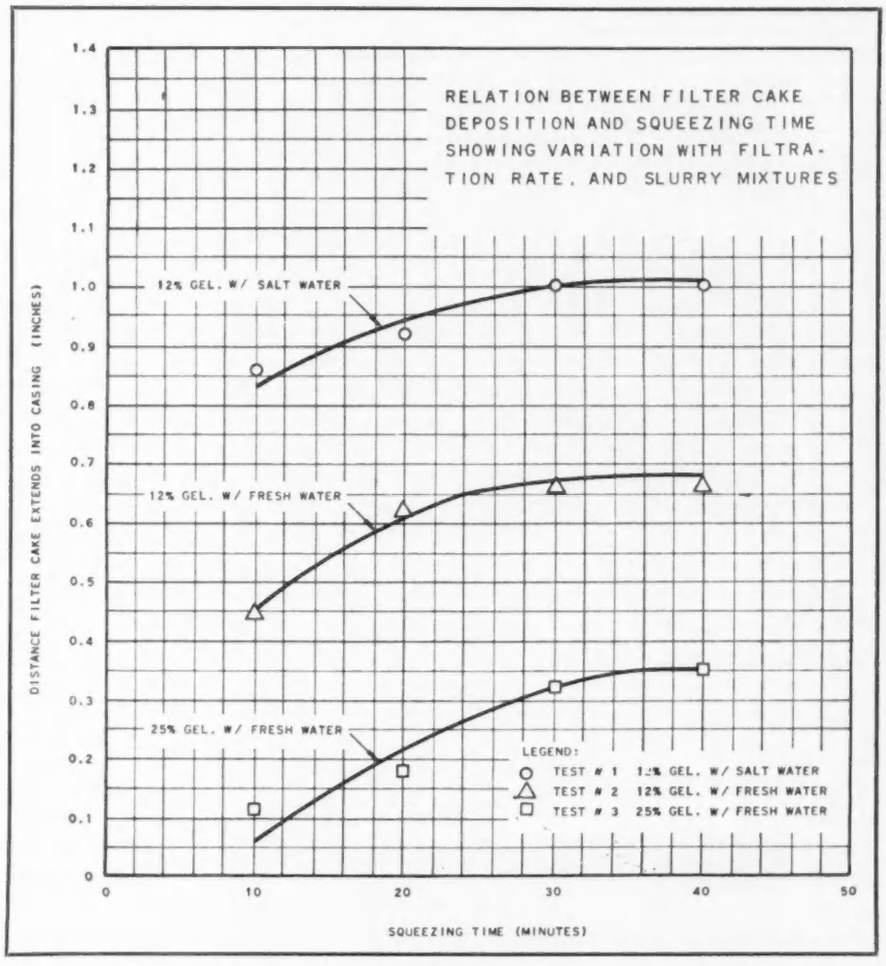

RELATION BETWEEN FILTER CAKE DEPOSITION AND SQUEEZING TIME SHOWING VARIATION WITH FILTRATION RATE, AND SLURRY MIXTURES
DISTANCE FILTER CAKE EXTENDS INTO CASING (INCHES)
SQUEEZING TIME (MINUTES)
12% GEL. W/ SALT WATER
12% GEL. W/ FRESH WATER
25% GEL. W/ FRESH WATER
LEGEND:
TEST # 1 12% GEL. W/ SALT WATER
TEST # 2 12% GEL. W/ FRESH WATER
TEST # 3 25% GEL. W/ FRESH WATER

FIGURE 2

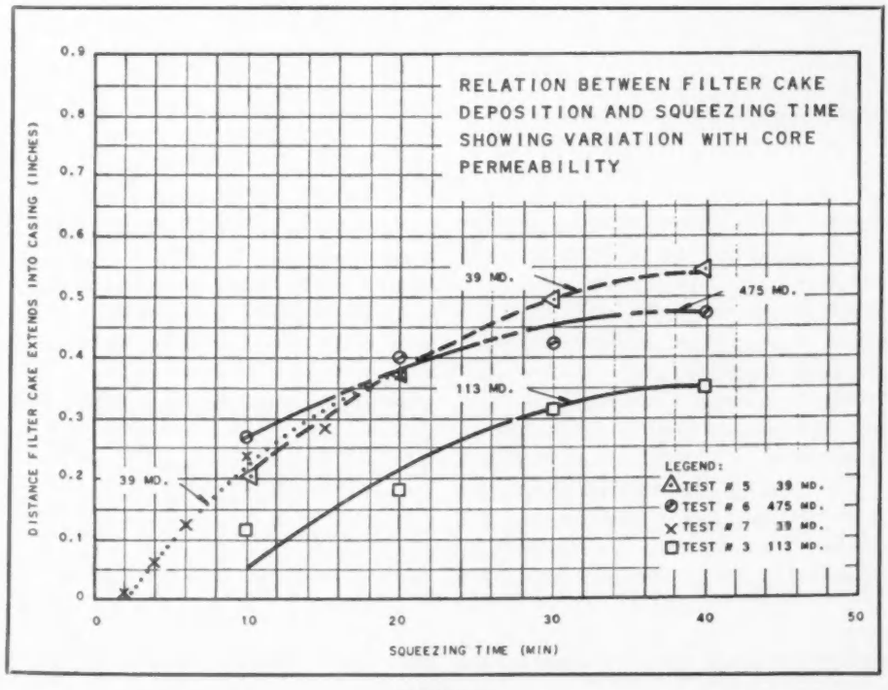

RELATION BETWEEN FILTER CAKE DEPOSITION AND SQUEEZING TIME SHOWING VARIATION WITH CORE PERMEABILITY
DISTANCE FILTER CAKE EXTENDS INTO CASING (INCHES)
SQUEEZING TIME (MIN)
39 MD.
475 MD.
113 MD.
39 MD.
LEGEND:
TEST # 5 39 MD.
TEST # 6 475 MD.
TEST # 7 39 MD.
TEST # 3 113 MD.

FIGURE 3

Surface equipment. With the initial introduction of the tubing-type perforator, some perforating companies made an effort to reduce the size and cost of the surface equipment used with this new small-diameter gun. Very little effort was made, however, to reduce the size or to modify the conventional wire line and cementing equipment used for permanently completed wells. Therefore, until a recent date, permanent-type well-completion operations have been performed with the conventional wire line choke trucks, large high-pressure cementing units, and, in many cases, with large perforating trucks.

Recently, two cementing service units have been constructed to permit a more thorough mixing of modified cement and to tailor these trucks for use with the permanent-type well-completion technique. In both types of units, the fresh water used to mix cement and the dry cement ingredients are transported to the location in

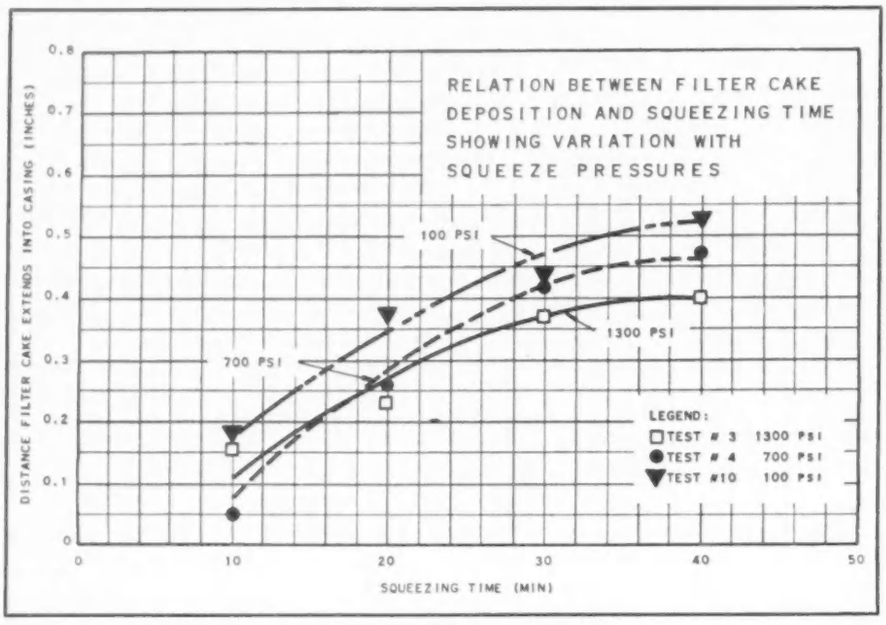


FIGURE 4

the cement trucks, thus eliminating the need for a bulk-cement truck and a tank truck.

Both units also carry their own centrifugal pump as a means of supplying salt water during the operations, eliminating the need for the oil company to supply gang labor and a pump for this operation.

Recently the service company supplying the two-pump, trailer-mounted cement unit also designed and equipped a single truck with an 0.082-inch piano-wire line and a $\frac{3}{16}$-inch single conductor cable to permit wire-line operations and perforating operations to be performed from one unit. This use of dual wire-line and trailer-mounted cementing unit has these advantages:

1. Coordination between operators of wire line and cementing units.
2. Reduction in manpower, inasmuch as it is possible for the operators to perform operations on both trucks without a duplication of effort.

To test the theory of unified service, a single permanent-completion unit has been constructed which combines cementing, wire line, and perforating operations in one vehicle. An effort has been made to reduce the size of this equipment in line with the requirements of the permanent-completion type of operation and still maintain a suitable factor of safety.

This permanent-completion unit permits coordination between pumping operations and wire line operations that has heretofore been impossible with two units. At the same time, the reduction in size and amount of equipment will permit speedier and simpler operations on barges, fills, and other locations where space is limited.

Sand exclusion. A method of removing produced sand from the well bore was discovered early in the use of permanent-type well completion. The problem of controlling produced sand when using this technique has also received field investigation. Since a permanently-completed well is completed in the absence of drilling mud and since the perforation holes should remain unplugged, it seemed feasible that this was the perfect environment in which to use consolidating plastics.

The use of the tubing extension permitted all salt water to be displaced from the well with oil to a point below the perforations and also permitted the plastic to be displaced across the casing perforations prior to injection into the formation sand.

Several wells completed in the absence of drilling mud were treated with consolidating plastic with success. However, it is too early to appraise this work accurately.

Field operations. To date several hundred wells have been reworked through the use of the permanent-type well-completion technique, and several thousand wells have been completed in such a manner that this technique may be used in the future. Complete workovers, without the use of a rig, have been performed in wells to depths in excess of 11,500 feet, and the tubing-type perforator has been used for the initial completion of wells at even greater depths.

This type of wire line, cementing, and perforating operation has been performed in various sizes of tubing and all sizes of casing, and even in small liners. Variations in the size of tubing, casing, or liners seemed to present no difficulty. Workovers have been performed on wells located in bays, bayous, fills, and other difficult terrain. This process has been used to obtain repeated economical tests in wildcat wells by permitting the drilling rig to be removed immediately after setting casing and running tubing. On numerous occasions it has been necessary to squeeze-cement a set of perforations and to reperforate the well in a lower interval.

To date, it has been necessary to move downward a maximum of approximately 400 to 500 feet. However, the amount of casing to be left open below the squeeze-cemented zone seems to present no difficulty. Because of different densities, there is a tendency for the cement to fall to the lower part of the casing if the cement is underlain by salt water. Therefore, it has been a practice to use sufficient cement when squeeze cementing this type of well to permit the cement to be a continuous column from the end of the tubing extension to a point above the perforations.

THROUGH-THE-TUBING SERVICES

Flowmeters. The increased use of through-the-tubing tools has stimulated work on other tools that may be run on a wire line in producing wells. The new flowmeter and sound device described by R. C. Rumble in his paper "A Subsurface Flowmeter," which was presented at the Petroleum Branch, AIME, Fall Meeting, 1954,

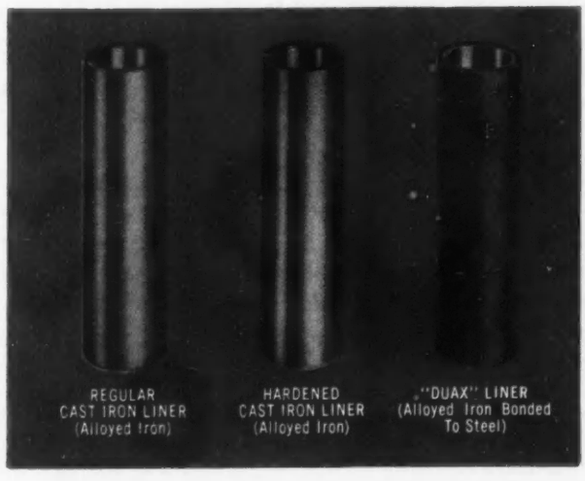
Permanent-Type Well Completions

This is trouble...

This liner (unretouched photo) was taken from a pump operating in a Mid-Continent oil field. Note how the effect of impact and corrosion has caused splitting and channeling. Cause of this breakdown might well be the operator's choice of a pump liner not designed to meet the conditions existing in the well.

This is trouble-free...

Here's why ... Each of the three Axelson pump liners is designed metallurgically and produced through special manufacturing processes to answer *specific* well conditions. Axelson is the only pump manufacturer operating *its own foundry*, thus establishing complete liner quality control from the beginning. If you have a problem involving abrasion, heavy impact or corrosion, check with your Axelson man for a correct specification.



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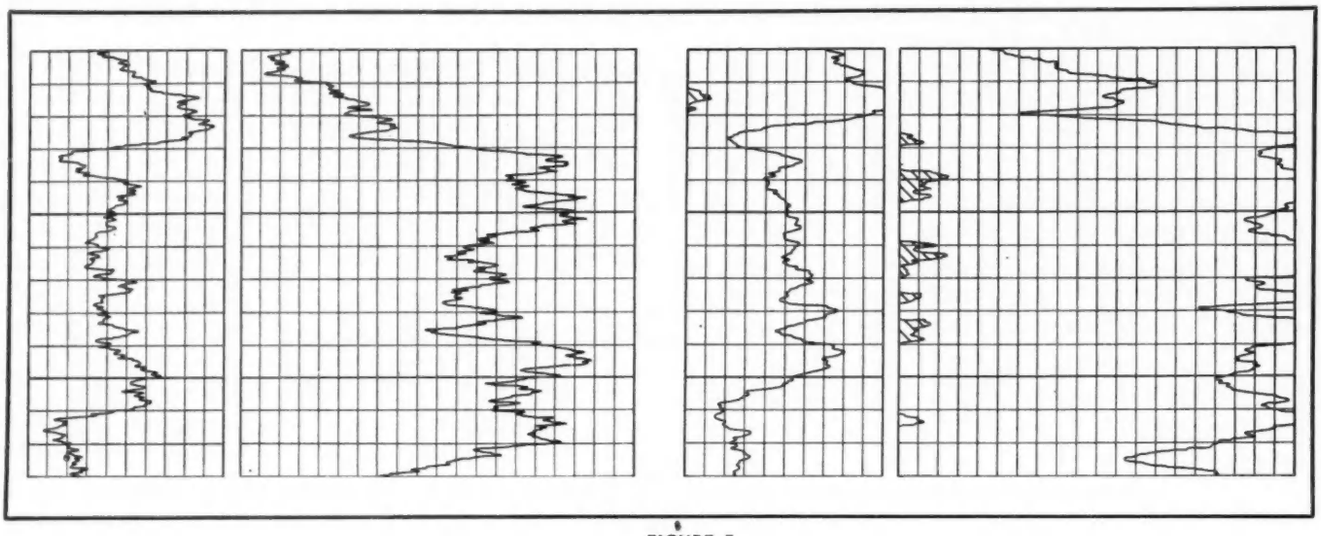


FIGURE 5

1¾-inch gamma ray and neutron survey run through tubing and casing. Conventional gamma ray and neutron survey run through casing.

is merely one of the new tools that will give field and reservoir engineers more knowledge of sub-surface conditions. Several flowmeters now developed by oil and service companies may be run through the tubing and operate in the casing while diverting all production through the instrument.

Logging instruments. The advent of 1¾-inch OD gamma ray and neutron logging devices now makes it possible to obtain radioactivity logs of old wells without pulling tubing. This permits definition of lithology when no previous logs have been obtained. In many instances this new tool will also enable the reservoir engineer to maintain constant observations of the level of reservoir fluid contacts.

Excellent correlation has been obtained between logs obtained with these small instruments and larger casing instruments. Figure 5 is an example of two logs run by different-sized instruments within a period of three days.

Perforating. Tubing-type perforators have now progressed to such a stage that a penetration job with a small gun run through the tubing is comparable with a conventional casing gun. The appearance within the past year of the swing-jet tubing gun, which is lowered down the tubing with charges in a vertical position and fires with the charges in a horizontal position, has been the first radical departure in tubing-type perforators since the original design in 1950.

More recently, experimental work has indicated that a new fixed-barrel tubing gun with charges designed as a result of intensive shaped-charge research will have greatly improved performance, particularly when used in a satisfactory completion fluid.

Thus far it has been impossible to obtain a satisfactory measure of the effect on well productivity which results from completing wells with a large pressure differential into the well bore. On the contrary, excessive pressure differentials into the well bore have created upward surges after perforating and, in some cases, were detrimental from a mechanical standpoint as gun debris was blown up the tubing and prevented withdrawal of the collar locator. Indications are, however, that some pressure differential into the well bore should increase well productivity.

The continued improvement in tubing-gun frangibility should reduce the cost of future through-the-tubing recompletions and eliminate the need to remove used gun cases. Heretofore, when aluminum gun cases have been encountered in the desired working interval, it has been a policy to dissolve the case with a caustic soda solution. In actual practice about 600 pounds of caustic soda have been added to 8 barrels of water and spotted in position through a tubing extension of ¾-inch steel pipe having telescoping joints at the lower end The solution is generally spotted by pumping ½ barrel or so around the end of the extension every 5 or 10 minutes. After several hours the spent caustic soda solution is removed from the well and other operations may progress.

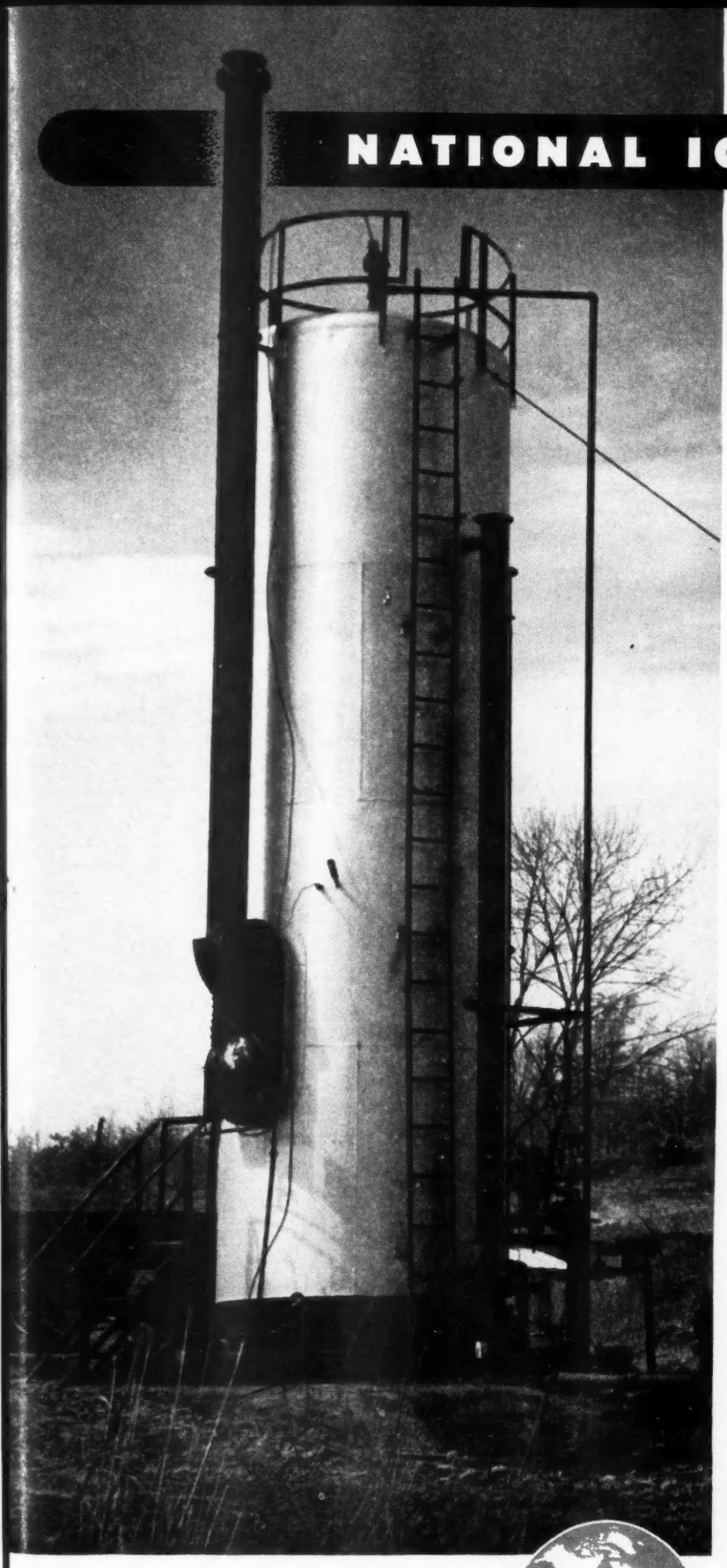
The tubing-type perforator has retained its popularity as a means of reperforating old wells and of increasing the perforated interval. Permanent-type well-completion techniques on abnormal-pressure wells have indicated the practicality of using the expendable tubing-closing plug when reperforating with the tubing gun in wells having a high surface pressure.

Permanent-Type Well Completions

ADVANTAGES OF PERMANENT-TYPE COMPLETIONS

Now that a good number of permanent-type well operations have been completed, some idea of the reduction in workover cost possible through this technique is available. Recently an analysis was made of the permanent-type well-completion operations performed during 1954 over a rather large area of operation where this technique has become relatively routine. When compared with the conventional method of reworking wells with a rig that had been used

NATIONAL IC-P TREATER

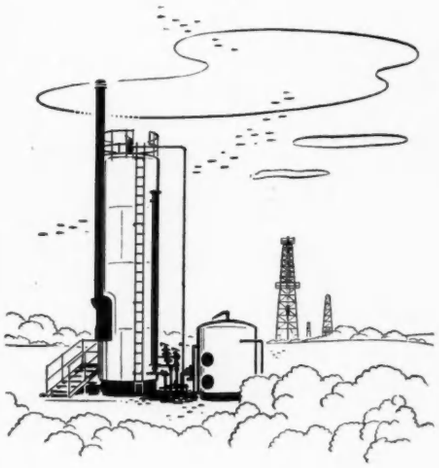


HANDLES
776,920 BBLS. OF OIL
823,486 BBLS. OF WATER
IN THREE YEARS

This 8' x 27'6" National IC-P Treater was set on a lease in Hughes County, Oklahoma. In approximately three years, this Treater handled 776,920 bbls. of oil, with a substantial increase in conserved gravity, and 823,486 bbls. of water. At times, rate of crude flow through the Treater was as high as 3400 bbls./day when wells were at peak production.

Average treating temperature is about 140°. Approximately 1 quart of chemical is used per 100 bbls. of oil. During this three-year period, tank bottoms were never cleaned or treated.

Present daily production is 1742 bbls. of 36.4 gravity oil and 3138 bbls. of water per day. This excessive amount of water has required the installation, recently, of a National Free Water Knockout.



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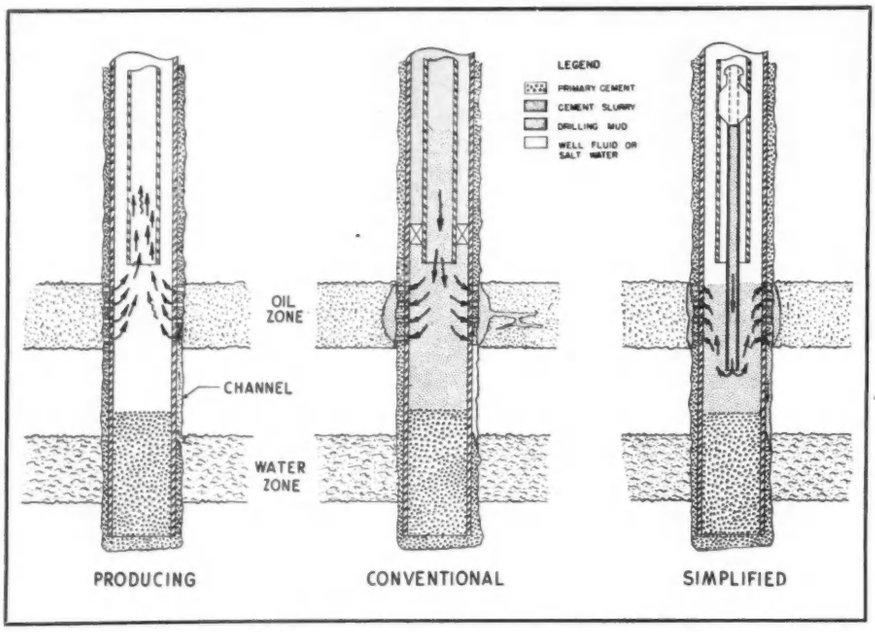
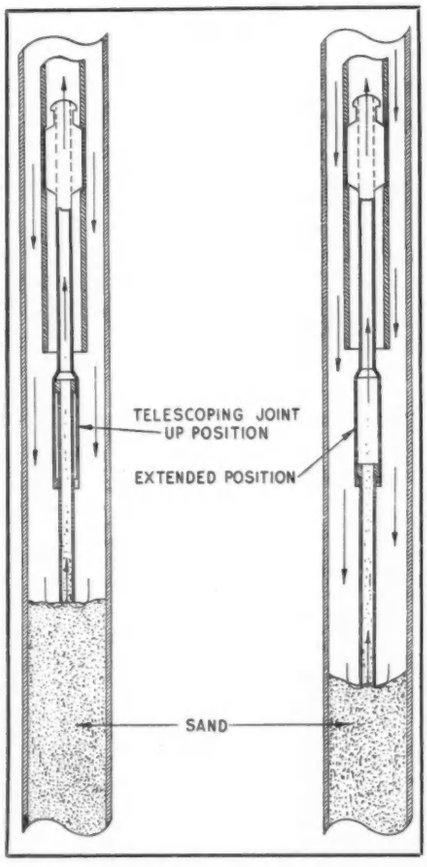
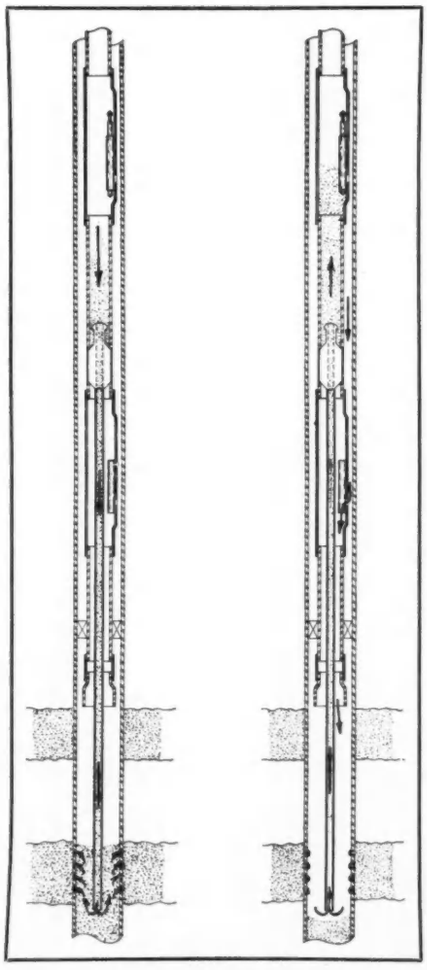


Filling a channel behind production casing with cement by using conventional and low-pressure squeeze techniques.



Washing sand from well bore using retrievable tubing extension.



Use of wire line retrievable tubing extension with a production packer and retrievable gas-lift valves.

Illustrations on this page from a paper presented by the authors at the Tenth Anual Short Course on Gas Technology, Texas College of Arts and Industries.

during the previous year, it became apparent that this permanent-completion technique saved approximately 40 percent in workover costs.

The area analyzed contained wells of shallow depth where a small pulling unit could be used, as well as shallow-water locations where barge rigs must be used for workover purposes. Not only was a cost reduction realized, but two other facts became readily apparent through this analysis, viz.:

1. During the past year there has been a decided reduction in difficulties such as line breakage, equipment failures, and errors in judgment. During the latter part of 1954 and the initial part of 1955, all jobs were performed without any serious difficulty, possibly because of more experience and better coordination between service personnel and oil-company personnel.
2. An increase in the number of formation tests per workover was realized. Geologists took advantage of the low cost of the permanent-completion technique to test all possible fluid-producing formations penetrated by the well bore.

It has now become possible to rework a well in a 24-hour period, and the increased efficiency of service personnel should make possible 1- to 2-day workovers on a routine basis. The amount of initial preparation of the well, the type of sub-surface equipment, and the amount of interval to be perforated will affect the time required to rework the well and its final cost. However, there is no appreciable increase in time or cost as a result of greater depths. As efficiency increases and unified service becomes available, it will soon be possible to perform complete workovers for as little as $1000.

To date better than a dozen wells have been reworked without killing them with drilling mud or salt water, and it has been possible to run the tubing extension, cement, and remove

Continued on Page 148

Permanent-Type Well Completions

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FOR HEAVY DUTY
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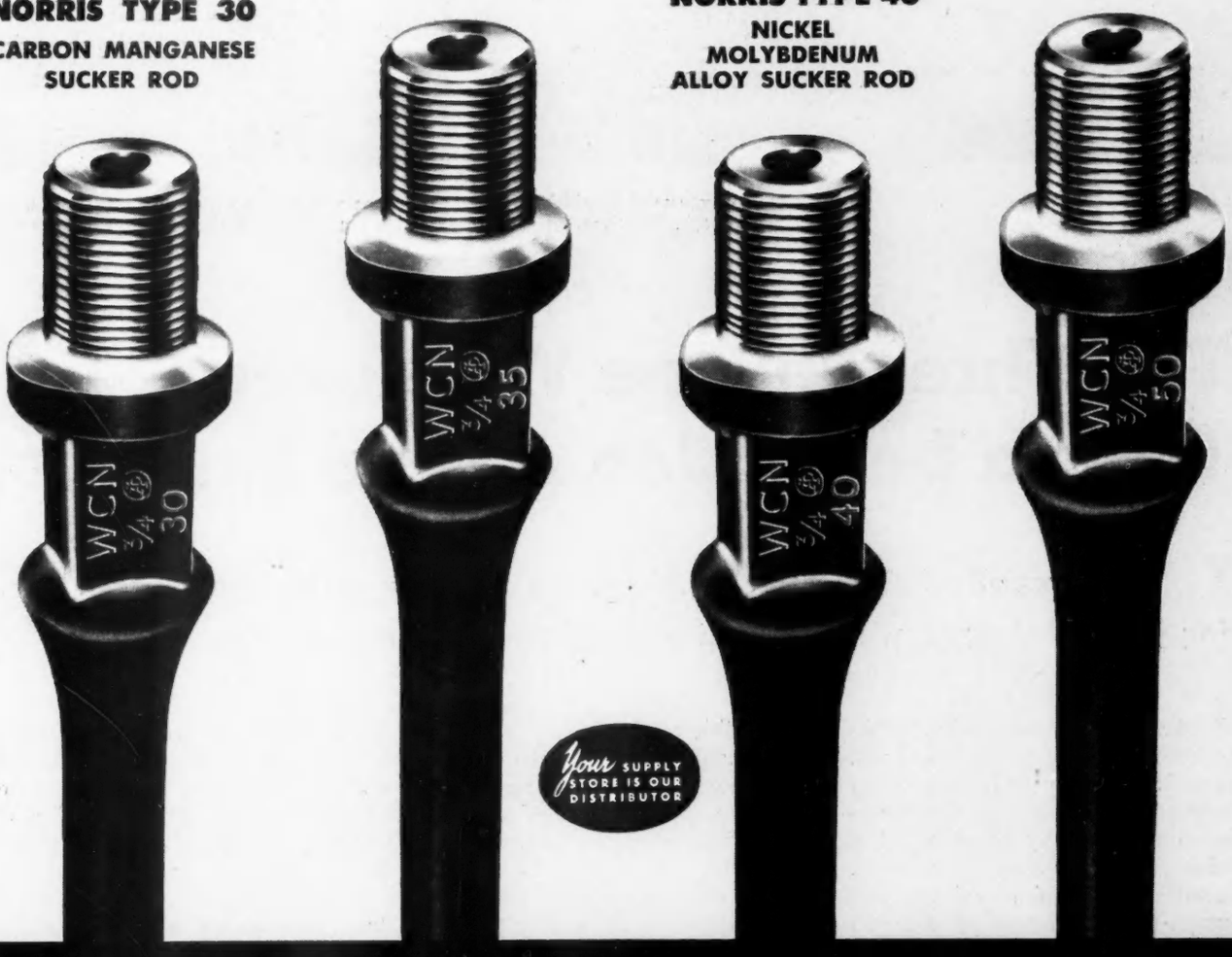
NORRIS TYPE 40
NICKEL MOLYBDENUM ALLOY SUCKER ROD

FOR HEAVY DUTY
SEVERE CORROSION

NORRIS TYPE 50
HIGH NICKEL MOLYBDENUM STEEL SUCKER ROD



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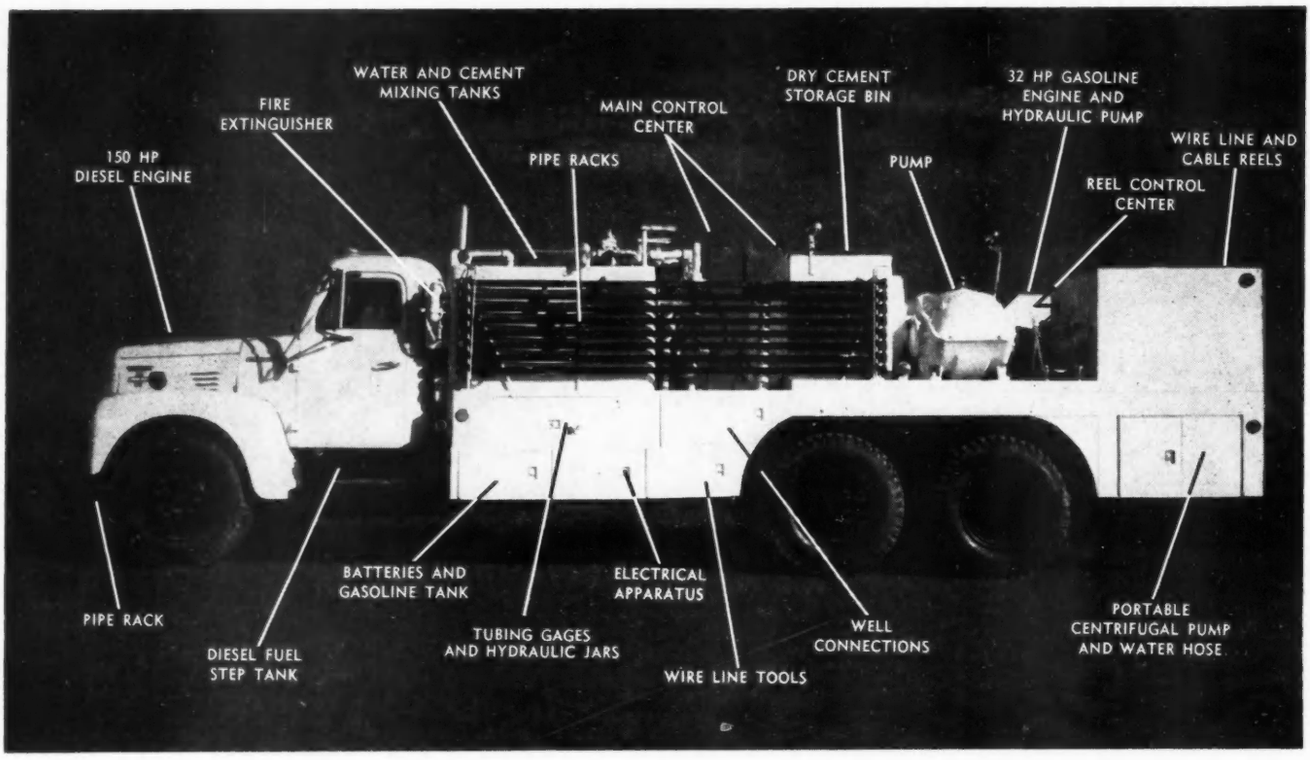


1 **Main features of Humble's unique triple-purpose well-servicing truck are identified in this photograph. Additional storage compartments are located on the other side and rear of the unit.**

This Three-in-One Workover Truck Does a Better Job at Less Expense

Specially-designed unit permits a single truck to do the complete well servicing job, including all wire line, gun perforating and cementing.

SUBSTANTIAL ECONOMIES in reworking permanent-type completed oil and gas wells have been made possible by a especially designed triple-duty workover truck. Built by Humble Oil & Refining Company research engineers, this versatile and unique unit can perform wire line, cementing and gun perforating operations.

Normally, a workover job involving these operations requires at least three separate service trucks and operating crews. One truck must be called out to do the wire line work; another to do the cementing; still another for gun perforating. Often two additional trucks are needed—one to haul dry cement; the other to haul water. Inevitably there are delays when operations get off schedule. Time is wasted when one truck must stand idle while another is completing its work. Since all well service companies necessarily charge for their equipment and operators on an hourly basis, any waste of time represents additional expense.

With the combination workover unit, however, there are no such problems. The big truck moves onto the location under its own power, and remains there until the workover job is completed. Except for the gun perforation instruments, which are mounted for convenience in a station wagon, everything needed for the complete workover project is built into or stored on the truck.

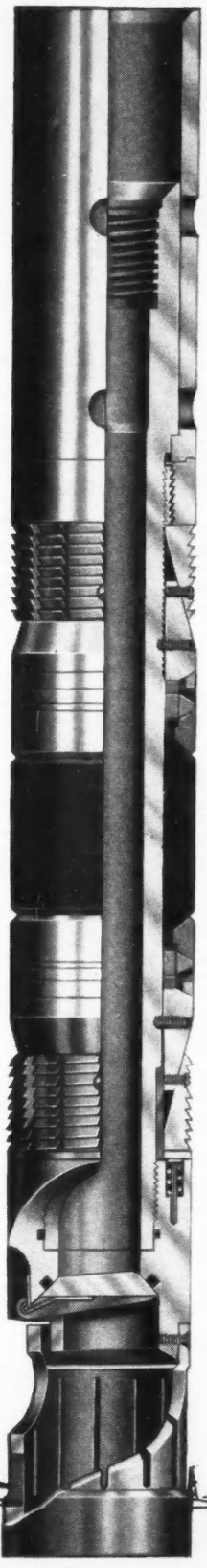
The diesel engine that propels the truck also powers the main pump. An auxiliary engine, mounted near the rear of the vehicle, powers the wire line reels and hydraulic equipment. There is a cement storage bin; also built-in water tanks which double in service as cement mixing tanks. Neatly stored in various compartments on the truck are all the tools,

For Permanent-Type Well Completions

THE BAKER

RETAINER PRODUCTION PACKER

PRODUCT NO. 415D



BAKER PACKERS ADD PERMANENCE TO PERMANENT-TYPE WELL COMPLETIONS

When you select a Packer for a Permanent-Type Well Completion, remember this fact: of all the tools used in permanent-type well completions, only the *Packer* is required to be *permanent*. Guns, Extensions, Plugs, Gas-Lift and Circulating Valves can be removed or replaced on wire line . . . but the Packer, like the casing, is required to perform for the life of the selected producing intervals. Baker Packer Completions are Permanent Completions from the standpoint of packer performance.

Advantages of Baker Retainer Production Packer in Permanent-Type Well Completions:

PERMANENT, RELIABLE PACK-OFF will hold against any pressure differential from above or below that is safe for the casing.

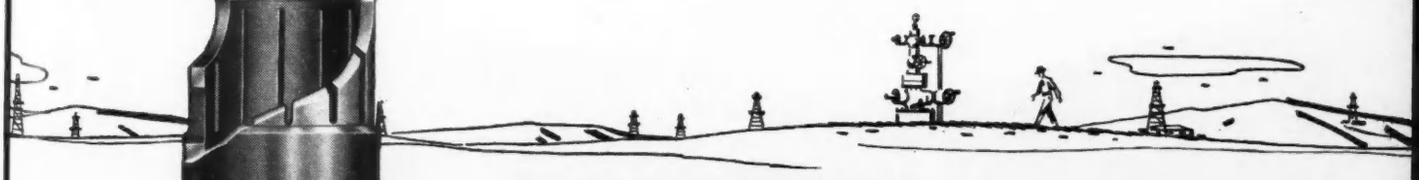
FREE TUBING STRING . . . neither set-down tubing weight nor tubing tension required to achieve and maintain pack-off. Tubing can be anchored to Packer if desired.

CAN BE USED AS A SQUEEZE OR A PRODUCTION TOOL.

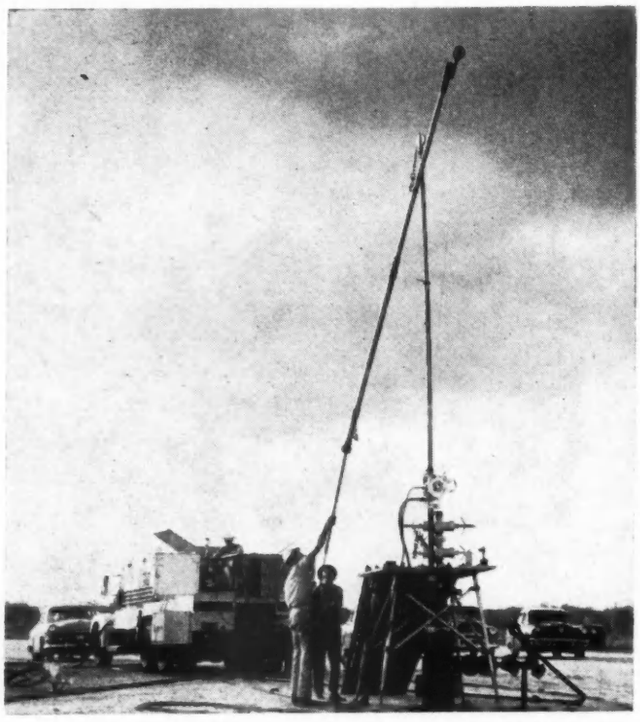
MEETS PERMANENT-TYPE WELL COMPLETION DIMENSIONAL REQUIREMENTS.

CAN BE SET ON WIRE LINE. PERMITS EASY REMOVAL OF TUBING STRING.

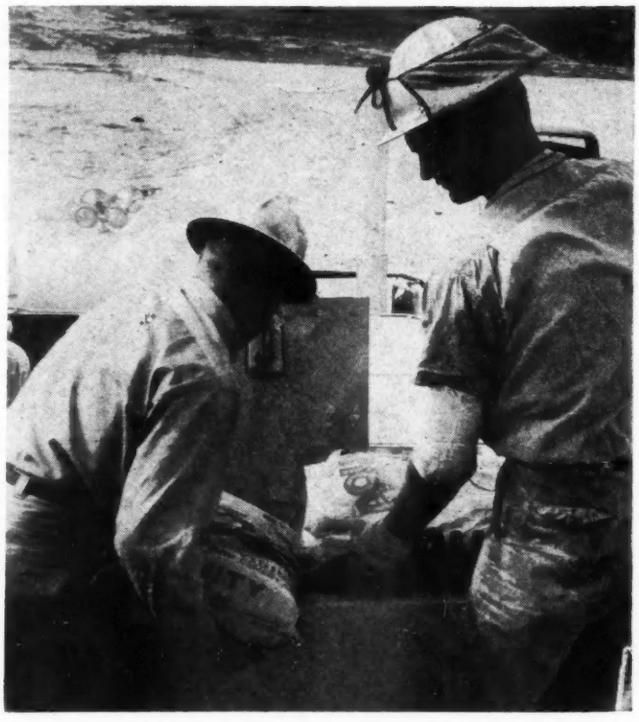
READILY DRILLABLE IN CASE OF EMERGENCY OR NEED.



BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

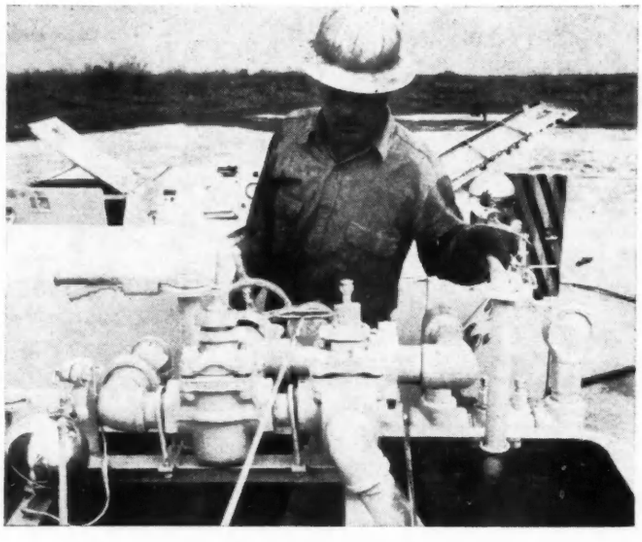


2 Wire line work follows normal procedures, with reels located in rear of truck unit and operator facing rear of truck. Aluminum tubing, gin pole, well platform, and pipe connections are carried on the truck.



3 Cement mixing is done in water tank built into truck. Twelve barrels of slurry can be mixed at one time, stirred by a water jet propelled agitator. A covered storage bin located near mixing tank holds 40 sacks of dry cement.

4 Gun perforating operations are carried on with aid of instruments mounted in station wagon. A microphone enables man in station wagon to communicate with cable reel operator on truck.



5 Control center on deck of truck gives operator complete control over the main diesel engine and all operations involving the big pump. From here he can keep a close check on pressures.

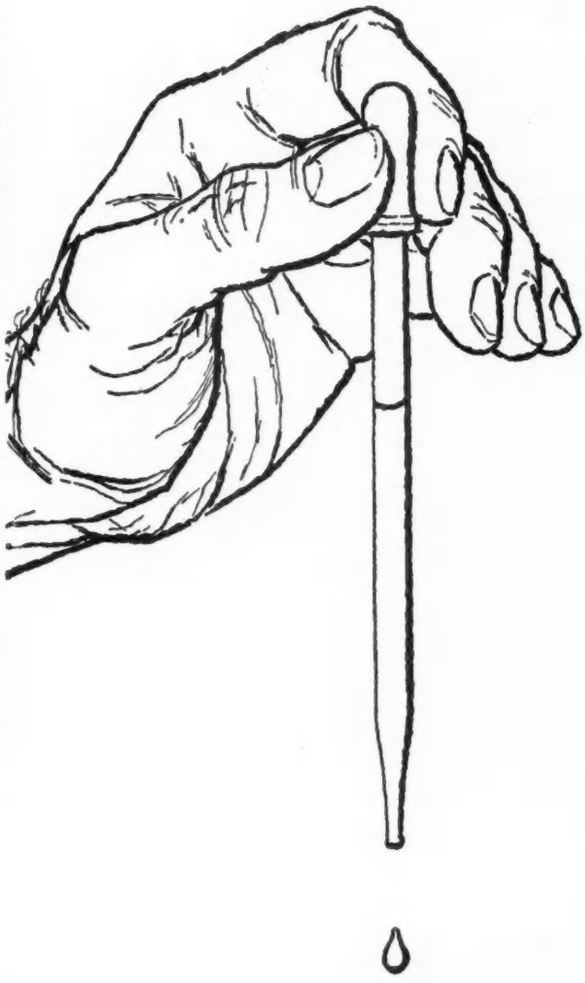
fittings, tubing, blowout preventers, and other necesary equipment.

In a few months of operation, the unusual vehicle has demonstrated its ability to do its work better than the standard equipment, and much more economically. Judged on the basis of its limited experience to date, the combination unit bids to cut about two-thirds off the cost of well workovers.

The main purpose behind Humble's development of the combination unit was to demonstrate the practical economies of one-truck well servicing, and so encourage commercial service companies to adopt the method.

Weight Big Problem. One of the biggest problems in designing the workover truck was to keep it within legal weight limits allowed on public highways. Humble engineers had to use all their ingenuity to shave excess pounds without jeopardizing the efficiency of the unit. They substituted aluminum for steel wherever possible, cut large perforations in the heavy

Permanent-Type Well Completions



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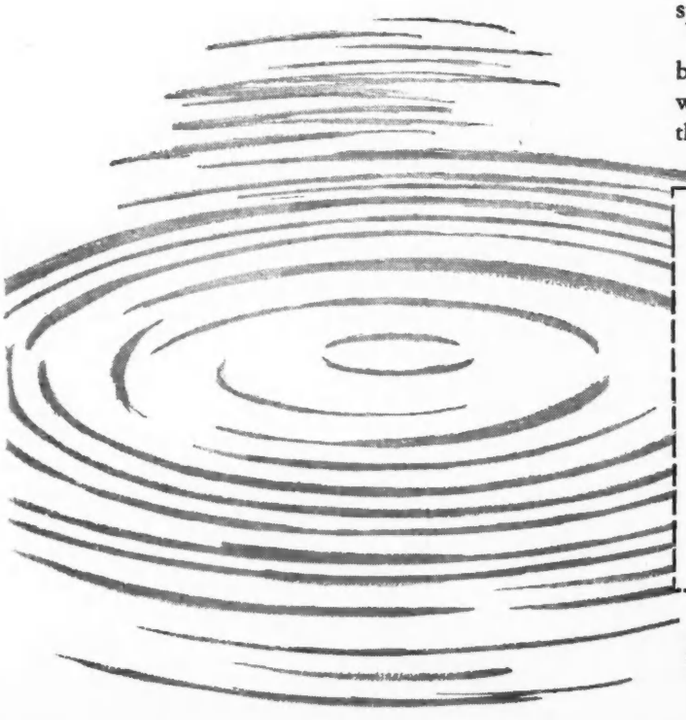

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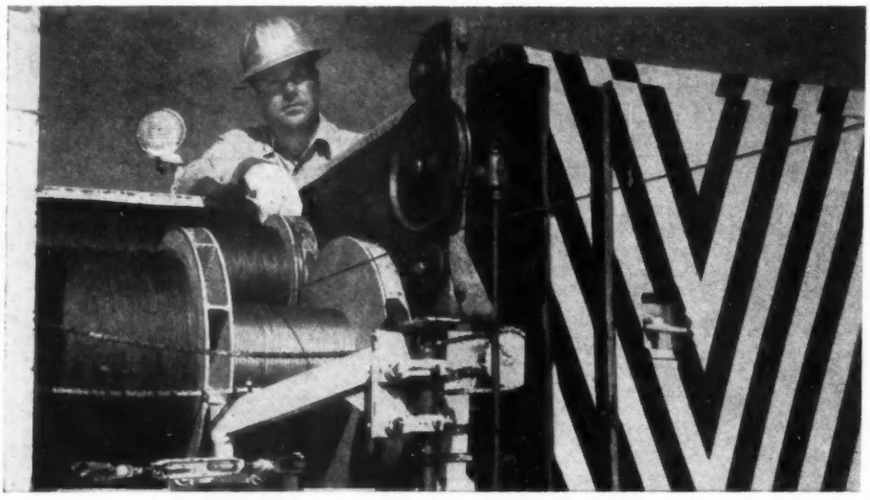


6 Three spools permit variety of operations. Line being unreeled in picture is special small-diameter perforating gun cable. To the left is a spool of strand cable; top reel contains solid wire line. Single level winding guide serves all three spools.

7 Workover truck in process of pumping salt water into the well to circulate out all oil and gas before sealing off old perforations with cement and then reperforating. Operation is under control of man standing on truck.

truck frame, and juggled their plans to permit better weight distribution between front and rear axles. Finally, they had a vehicle that comes safely within the legal load limits. Even so, it weighs more than 20 tons when fully loaded.

But weight limitations did not prevent inclusion of several unusual features to improve the unit's operations. A good example is the hydraulic system, powered by a 32-horsepower gasoline engine which has been sparkproofed for safety. The hydraulic system operates a vane-type hydraulic motor that controls the drum reels. This gives a smooth flow of power for wire line and cable work. An automatic bypass valve can be adjusted so as to prevent excessive pull on the line, a valuable safety factor should a tool hang up in the well.

The same hydraulic system serves two other purposes. It operates the centrifugal pump that pumps water from the pit to the tank on the truck, and it drives the hoist used to pull tubing from the well.

ACKNOWLEDGMENT

This article reprinted from *Humble Way* through the courtesy of Humble Oil & Refining Company.

—The End

Permanent-Type Well Completions

New Developments

Continued from Page 142

the extension with as much as 1300 psi surface pressure on the well. By using 10-pound per gallon salt water or 12-pound per gallon calcium chloride water as a circulating fluid, it is possible to rework wells with formation pressure gradients as high as 0.70 without contaminating the formation with conventional drilling mud.

The substantial reduction in workover and completion costs obtained through the use of the permanent-completion technique may be further reduced by the use of a unified service because of the following:

1. A reduction in well-servicing manpower.
2. A reduction in dispatcher, accounting, and sales forces, because all operations may be performed by one company.
3. Increased efficiency through coordinated services.

It becomes apparent that this type of operation will also reduce the work load of the oil company personnel by eliminating the number of service companies that must be contacted and the amount of coordination that is required to have all vehicles at the well site at the correct time. It also means that the entire operation performed by service personnel may be under the supervision of one man.

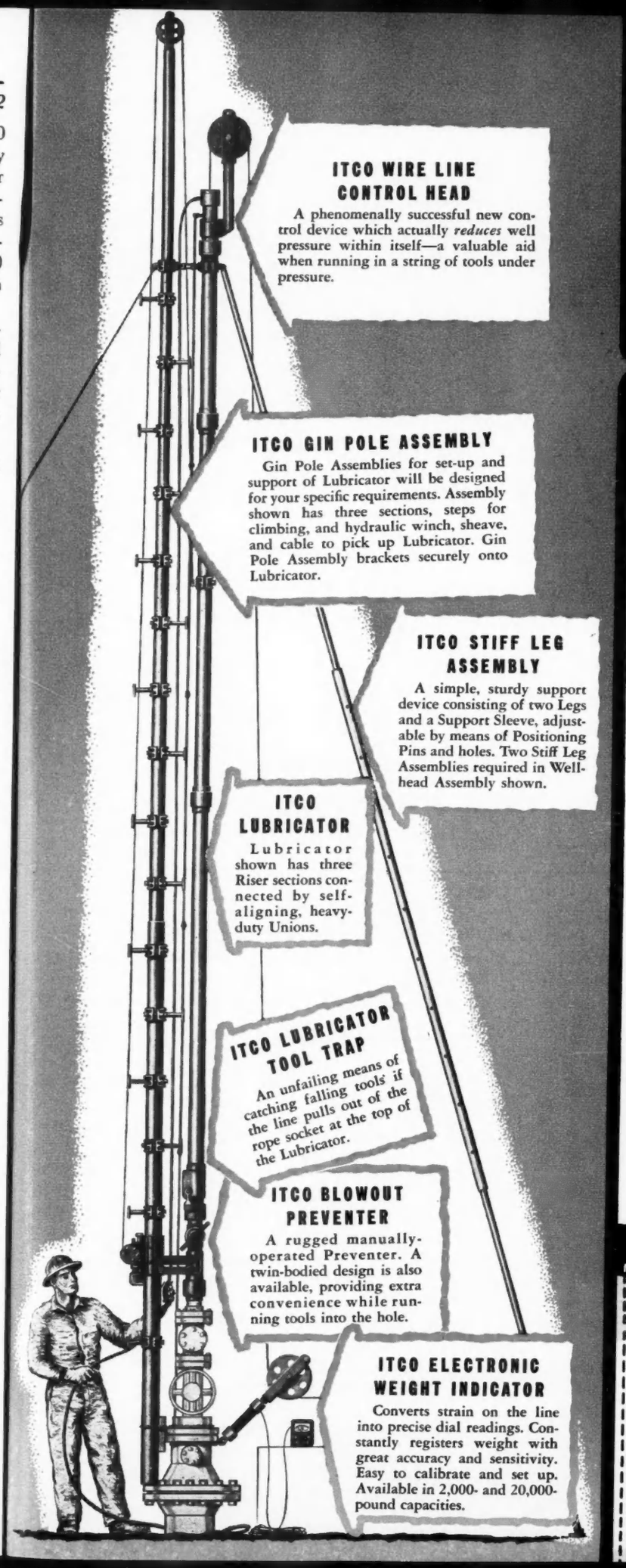
CONCLUSIONS

1. Wells may be reworked or completed with a large reduction in cost using the permanent-type well-completing technique.
2. A unified service offered by one company is practical and offers advantages of coordination, efficiency, and speed.
3. Wells may be reworked in 1 to 2 days.
4. The use of the simplified squeeze-cementing technique and the tubing-type perforator, combined with other techniques developed for this economical method of reworking wells, has proved practical and has given engineers better information as well as better control of wells.

ACKNOWLEDGMENT

This article was presented under the title of "Permanent-Type Well-Completion Developments" at the spring meeting of the Southwestern District of the API Division of Production, March 9-11, 1955, New Orleans.

—The End


ITCO WIRE LINE CONTROL HEAD
A phenomenally successful new control device which actually *reduces* well pressure within itself—a valuable aid when running in a string of tools under pressure.
ITCO GIN POLE ASSEMBLY
Gin Pole Assemblies for set-up and support of Lubricator will be designed for your specific requirements. Assembly shown has three sections, steps for climbing, and hydraulic winch, sheave, and cable to pick up Lubricator. Gin Pole Assembly brackets securely onto Lubricator.
ITCO STIFF LEG ASSEMBLY
A simple, sturdy support device consisting of two Legs and a Support Sleeve, adjustable by means of Positioning Pins and holes. Two Stiff Leg Assemblies required in Wellhead Assembly shown.
ITCO LUBRICATOR
Lubricator shown has three Riser sections connected by self-aligning, heavy-duty Unions.
ITCO LUBRICATOR TOOL TRAP
An unfailing means of catching falling tools if the line pulls out of the rope socket at the top of the Lubricator.
ITCO BLOWOUT PREVENTER
A rugged manually-operated Preventer. A twin-bodied design is also available, providing extra convenience while running tools into the hole.
ITCO ELECTRONIC WEIGHT INDICATOR
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PERMANENT COMPLETIONS

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The unprecedented convenience of being able to obtain a complete wellhead assembly—*as a unit installation engineered to your specific operating requirements*—can now be yours. This installation—The Bowen-ITCO Complete Wellhead Assembly—incorporates all lubricator-wellhead equipment essential to most permanent completion and well-servicing operations.

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New Instruments Provide Good Thru-Tubing Logs

Logs made with small diameter tools are now comparable in quality with those of larger detectors.

SMALL DIAMETER logging devices have been developed to fulfill the need for instruments which can be used in wells completed by the permanent-type or thru-tubing method.

In developing these small diameter instruments, logging service companies found it necessary to make a number of electronic changes to obtain satisfactory records. The small instruments now have been improved to provide logs comparable in quality with those made with larger detectors. Sensitivities can be increased when surveying thru-tubing to compensate for the additional fluid in the annulus of tubing to casing, as well as the additional metal of the tubing. Tubing collars, packer and casing collars are electrically located simultaneously with either gamma ray or neutron instruments.

To date these thru-tubing logging devices have been run under many different conditions and for various purposes, and their performance indicates a wide range of application.

Available instruments. The availability of this type of equipment is somewhat limited at this time. However, the quantity available is being increased steadily by the logging service companies.

Both gamma ray and neutron logging instruments are available to the industry for thru-tubing operations. They are run separately on small diameter single conductor cables. Each instrument is equipped with an electromagnetic collar locator to pin-point casing collars as "down-the-hole bench marks" for stratigraphic purposes. The cable head of the instruments include a pull-out device in the event trouble is encountered.

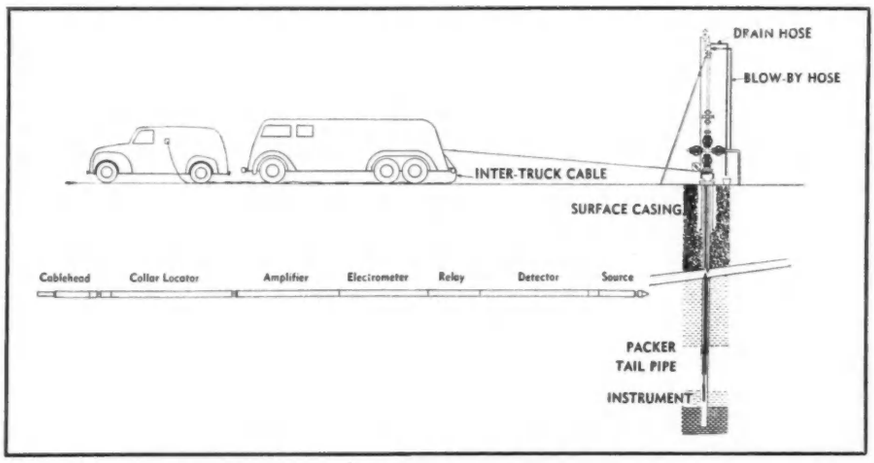

FIGURE 1—Field setup and well equipment.

The approximate physical dimensions and limitations of the instruments are listed in the following table:

	Gamma Ray	Neutron
Weight (pounds)	60	75
OD Diameter (inches)	1¾	1¾
Length (feet)	14½	13¼
Temperature Limits (° F)	300+	300+
Pressure Limits (psi)	15,000	15,000

The gamma ray instrument has a recording detector with an effective detecting length of 30 inches. It measures the count rate of gamma radiation from the formation in counts per minute per inch of pen travel and are recorded as continuous curves. More time is sometimes necessary to obtain proper deflection for thin sands. This slowdown allows the instrument to receive its full count rate. The sensitivity of the log is expressed in counts per minute and is easily computed from zero. A zero point is recorded on all logs.

The neutron instrument is of the neutron gamma process, and has an effective length of 10 inches. The detector is activated by a strong neutron source. It will provide stratigraphic character comparable to larger diameter instruments. The same requirements of low speed is necessary to obtain full amplitude of the curve for thin beds. The instrumentation is capable of defining a dry gas to fluid contact within a bed and any gradation or transition in sedimentation.

Surface equipment. The greatest advantage of permanent-type completions is the release of heavy equipment at the well site during operation. Personnel or equipment other than that provided by the service company is kept to a minimum. The surface equipment, for a complete operation, is provided by the service

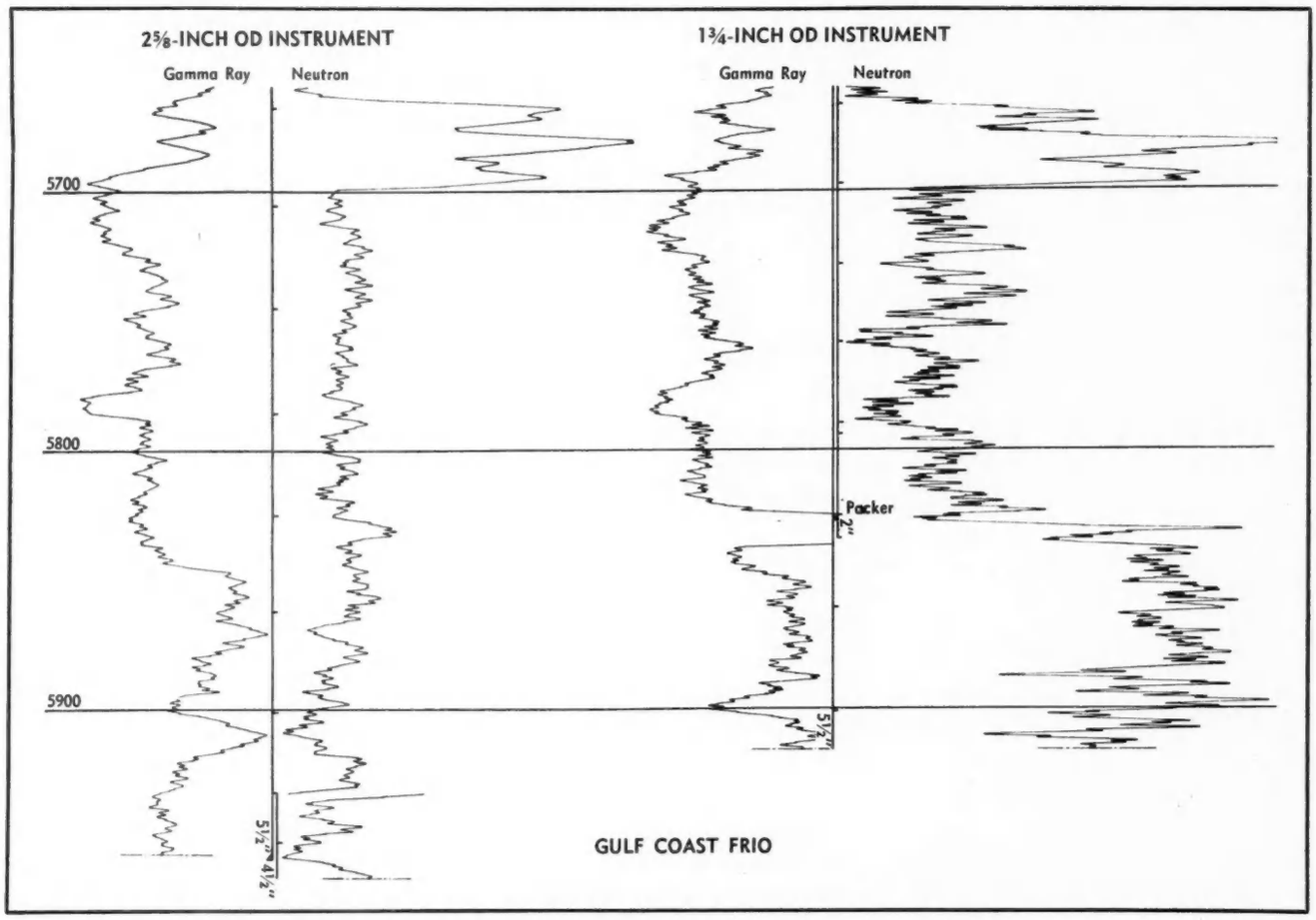

FIGURE 2—Comparison of radioactivity logging instruments in casing and thru-tubing.

company and includes adequate high pressure lubricators and blowout preventers to provide safety and control at all times. At present, the wire line blowout preventor and lubricator head, with a series of short pup joints, fulfill the requirement of safety and, by use of a "flow-by" tube, permit the service to be performed on gas-oil wells with pressures up to 3000 pounds per square inch.

The principle of the "flow-by" tube, an improvement to surface lubricator equipment, is to provide a friction free pack off around the line through a choke arrangement to slow the rate of fluid bypass between the inside diameter of the tube and the line. The bypass fluid is controlled by a valve on a high-pressure hose.

Small diameter tools can be run on smaller diameter cables and consequently permit smaller service panel and hoisting units at the well site.

The smaller the cable and the heavier the tool, the greater the pressure that can be withstood in the hole. Reasonably safe operating limitations for two small diameter cables on fluid wells and dry gas wells, without a rig on location, are listed below:

	Pounds Per Square Inch	
	Fluid Wells	Dry Gas Wells
GAMMA RAY:		
3/16" Cable	1500	2000
5/16" Cable	450	850
NEUTRON:		
3/16" Cable	1850	2500
5/16" Cable	550	1000
Maximum Recommended Pressures With Sinker Bars For Both Instruments:		
3/16" Cable	2500	3000
5/16" Cable	800	1500

Figure 1 illustrates a typical field setup where the lubricating equipment at the wellhead has been designed for speed, safety and full control. On such a typical well, the tubing might or might not be on a packer.

It must be realized, of course, that cross pins or bull plugs in the tail pipe must be eliminated for a full traverse. Tools are available to provide the full opening and later replacement of the plug.

Advantages and applications. The economic factor of thru-tubing services is lower cost. A rig is optional and down time is minimized. Productivity need not be hindered by killing the well and allowables can be maintained or improved. With permanent type well completion methods, the well can be completed or recompleted with the minimum loss of production.

A large number of thru-tubing logs have been run to date—both on new and old wells. Present applications include the service in:

1. Wells that are still flowing, but were drilled and completed prior to any logging service, and which are now being surveyed for a base log.
2. Drill pipe where difficulty was encountered during drilling operation and basic electrical logs were prevented from being run.
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Permanent-Type Well Completions

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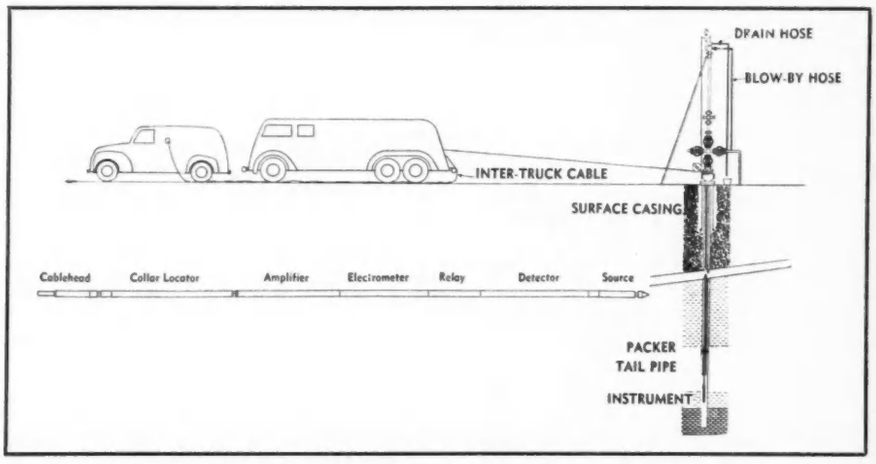

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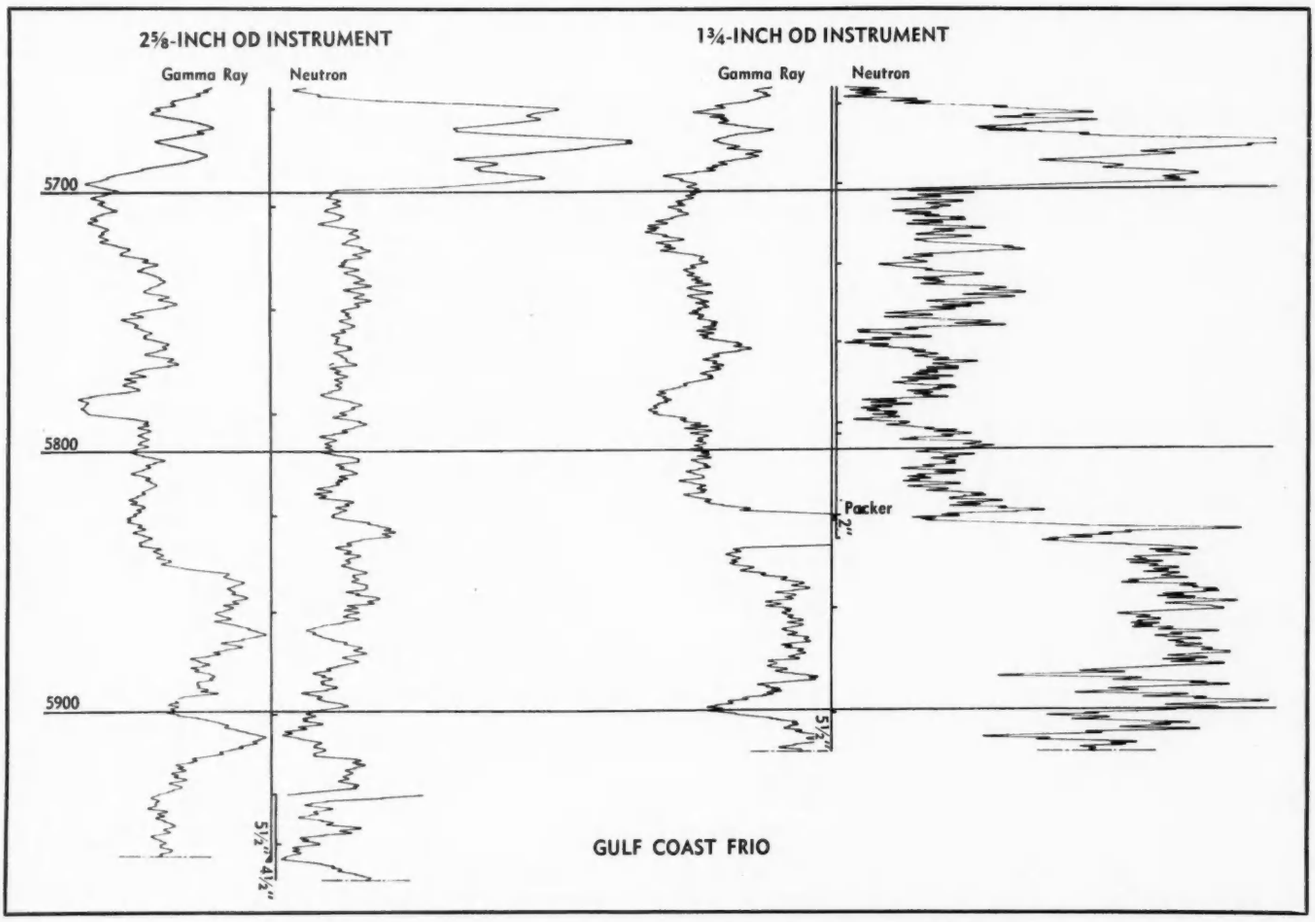

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Permanent-Type Well Completions

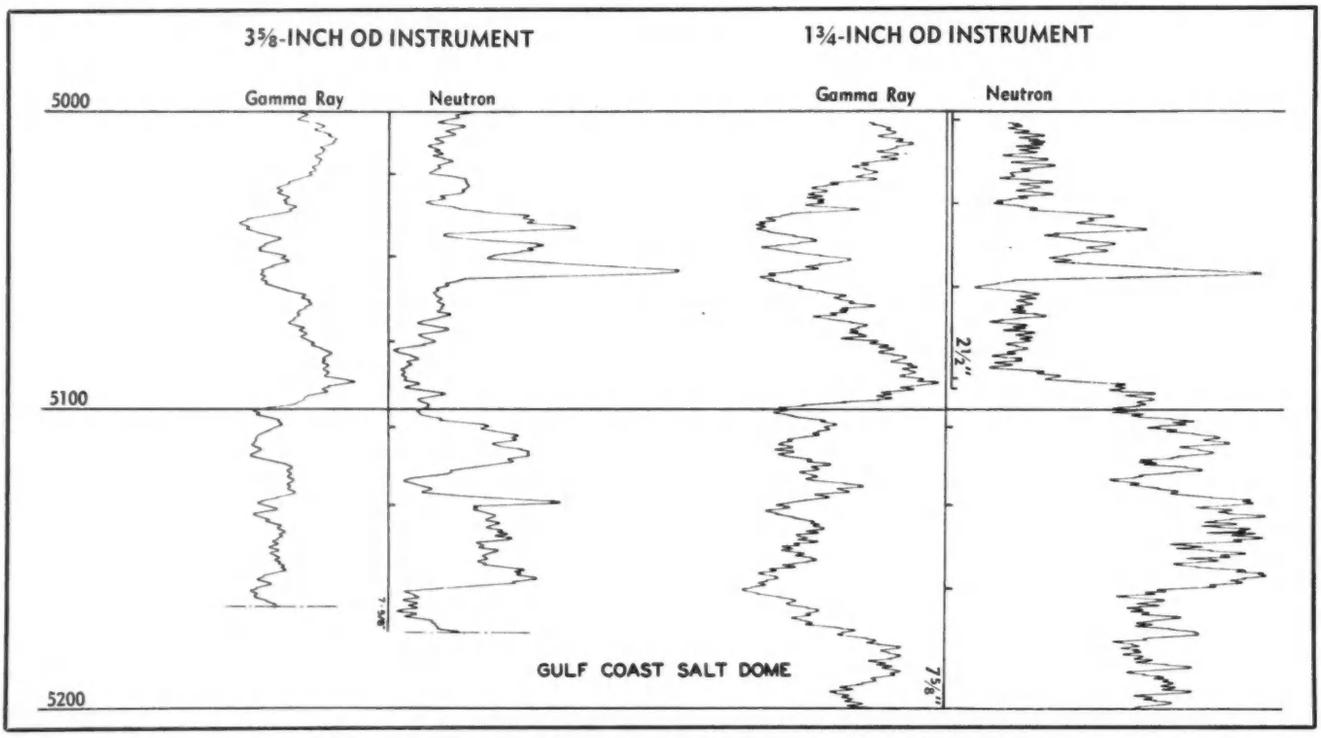

FIGURE 3—Comparison of radioactivity logging instrument in casing and thru-tubing.

4. Small diameter casing for slim-hole drilling and completion.
5. Liners and screens of small diameter, which were not necessary to pull for recompletion.
6. Location of gas cap, expansion or contraction.
7. Thin sand location.
8. Geological correlation and structural studies.
9. Thin zone porosity evaluation.
10. Sand and lime, gross and net reservoir statistics.
11. Tracers for injection and production, acid, frac, casing and tubing leaks.

Future applications will provide the industry with a tool for observing LPG storage, and the location of hydrocarbon to water contacts. This is possible, due to the specific gravity differential between the two fluids, where the density of a tracer permits floating at the water contact, without breaking surface tension. At the present time, low specific gravity tracers are being injected into gas storage units to determine fluid levels.

Due to the present Geiger counter arrangement of the equipment, it is entirely possible that different spacings, simultaneously recorded, will provide extra curves for determination of invasion and, consequently, possible gas production in sands beyond the invaded zone.

Typical logs. Figure 2 illustrates a Gulf Coast Frio well where large diameter 2⅝-inch outside diameter counter equipment was run in 5½-inch OD casing to locate a gas/fluid contact in a sand, and to evaluate the gross and net sand present in the producing section. Several months later, with the availability of small-diameter 1¾-inch OD instrumentation, an additional survey was run over the same interval with comparable definition. The gas/fluid contact is the same and easily recognized at 5698 feet. The gas zone, the fluid present and tight or dry streaks likewise are readily interpreted. A greater definition for thin sands can be noticed as compared to the large diameter instrument. This is the result of using slower logging speeds.

A noticeable shift is also indicated on the small diameter neutron, due to the packer arrangement in the casing. The casing collars are the same below the packer, and the 2-inch tubing collars are also located for additional information.

Figure 3 compares the standard 3⅝-inch OD instrumentation in 7⅝-inch casing, and the 1¾-inch OD small diameter thru-tubing instruments, in a like manner. The 2½-inch tubing is open ended, and without a packer. The sands and shales are clearly defined on this well, which is producing on the flank of a salt dome.

Within a short time it is entirely possible that better evaluation will be rendered on all radioactivity logs, whether in casing or thru-tubing. It is difficult to say what conclusions will be made on the type of fluid present within a sand, but it is reasonably safe to indicate a change from gas fluid due to the density of each within the reservoir. Thin bed definition and testing will increase the reserves available for field evaluation, and the tools, when available in quantity, will find ready use in the oil and gas industry.

ACKNOWLEDGMENT

This publication expresses its appreciation to the companies releasing the logs to make this article possible and to John Campbell, Lane Wells Company, for his assistance in the preparation of the article.

—The End

Permanent-Type Well Completions

The facts behind the Success of the

MARTIN CAGE

When pencil, paper and manufacturing skill were fused in the development of the Martin Cage, one guiding thought was held constantly in mind. *Make a better cage — a cage which would stand the terrific punishment that caused ordinary cages to fail.*

The result, of course, was the Martin Cage. And today, after years of use by economy-minded producers, this one significant fact remains undisputable. *With Martin Cages, ball and seat life is often doubled . . .* So successful has been the Martin Cage that some manufacturers are attempting to follow in its footsteps. Naturally, only Martin can make a Martin Cage.

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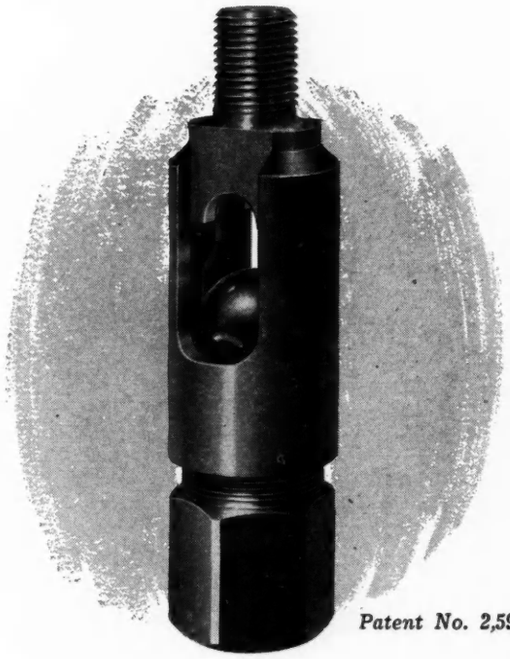

Patent No. 2,591,174

open and closed types . . . all diameters and styles. Write for the new John Martin Catalog No. 4, with helpful information on how to select the correct cage for your particular installation.

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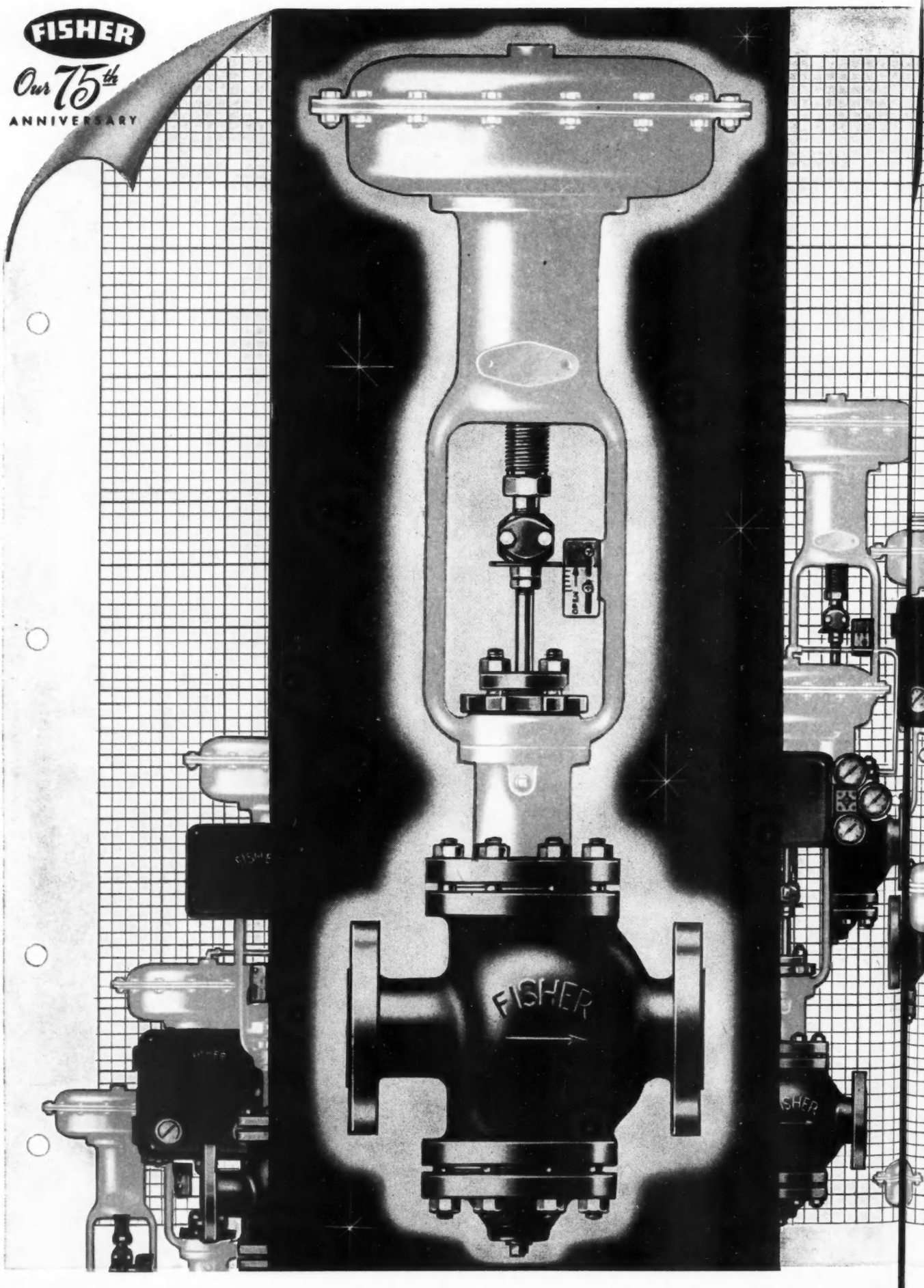

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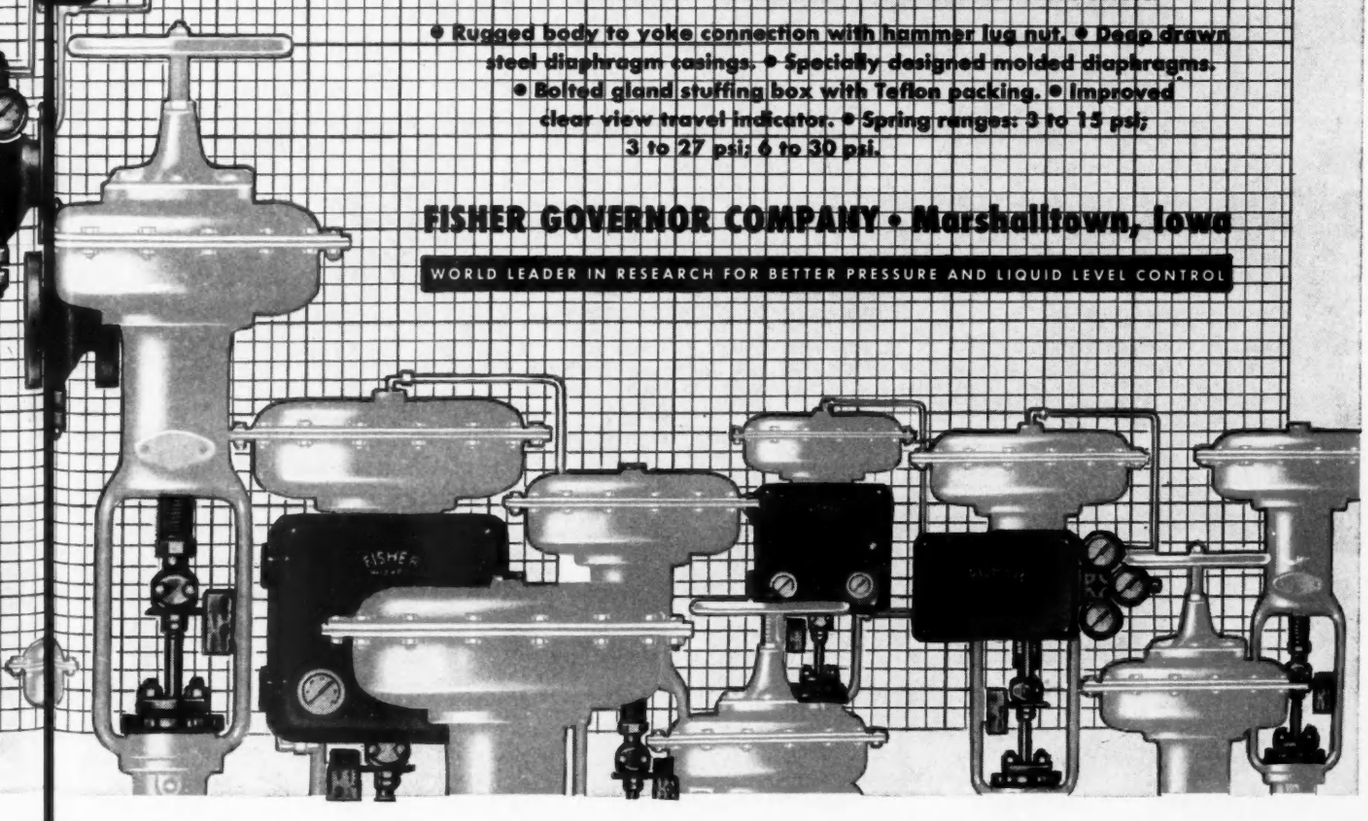
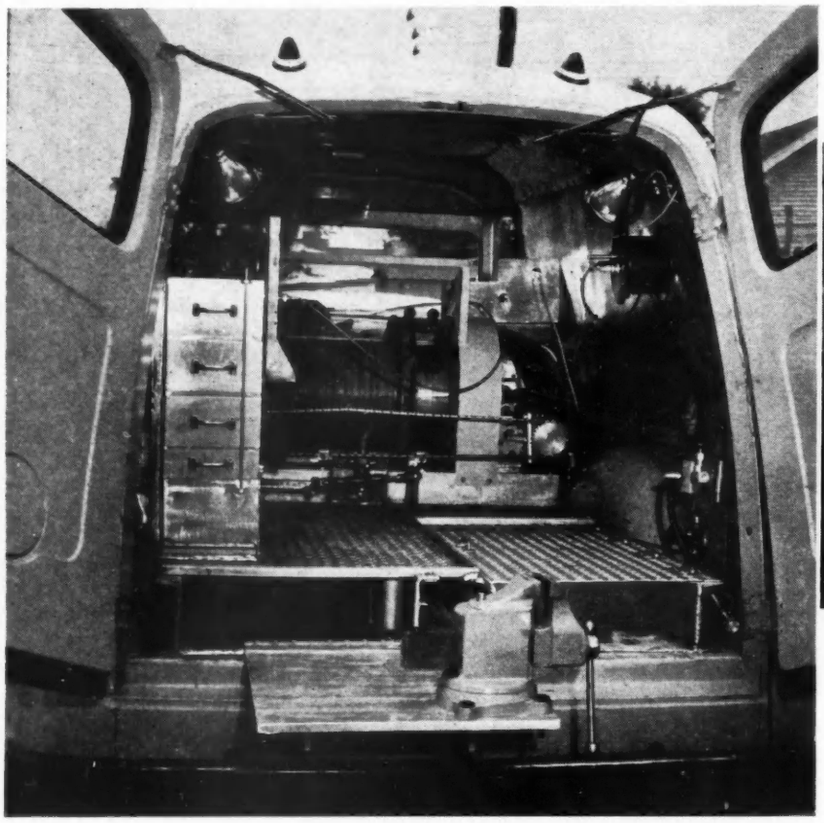
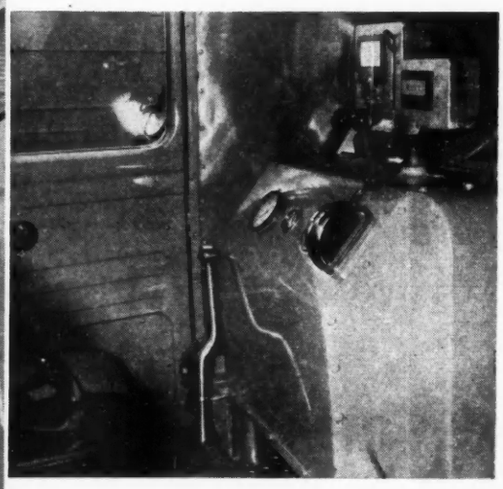




Interior of wire line service truck, with hoist in background.



Control panel of wire line service truck. It is located immediately to right of driver's seat and is operated from a swivel chair.

New Wire Line Service Truck

. . . provides quick, better and less expensive servicing of producing wells. Truck is compact, hydraulically-operated, electronically-controlled.

By JOE HENDERSON and H. E. McGOWEN, Camco, Inc.,
and **CECIL GREER,** Bowen Company of Texas

With the widespread acceptance of permanent-type well completions, a need developed for improved wire line servicing equipment. This has resulted in the introduction of a truck-mounted, hydraulically-powered, electronically-controlled wire line unit.

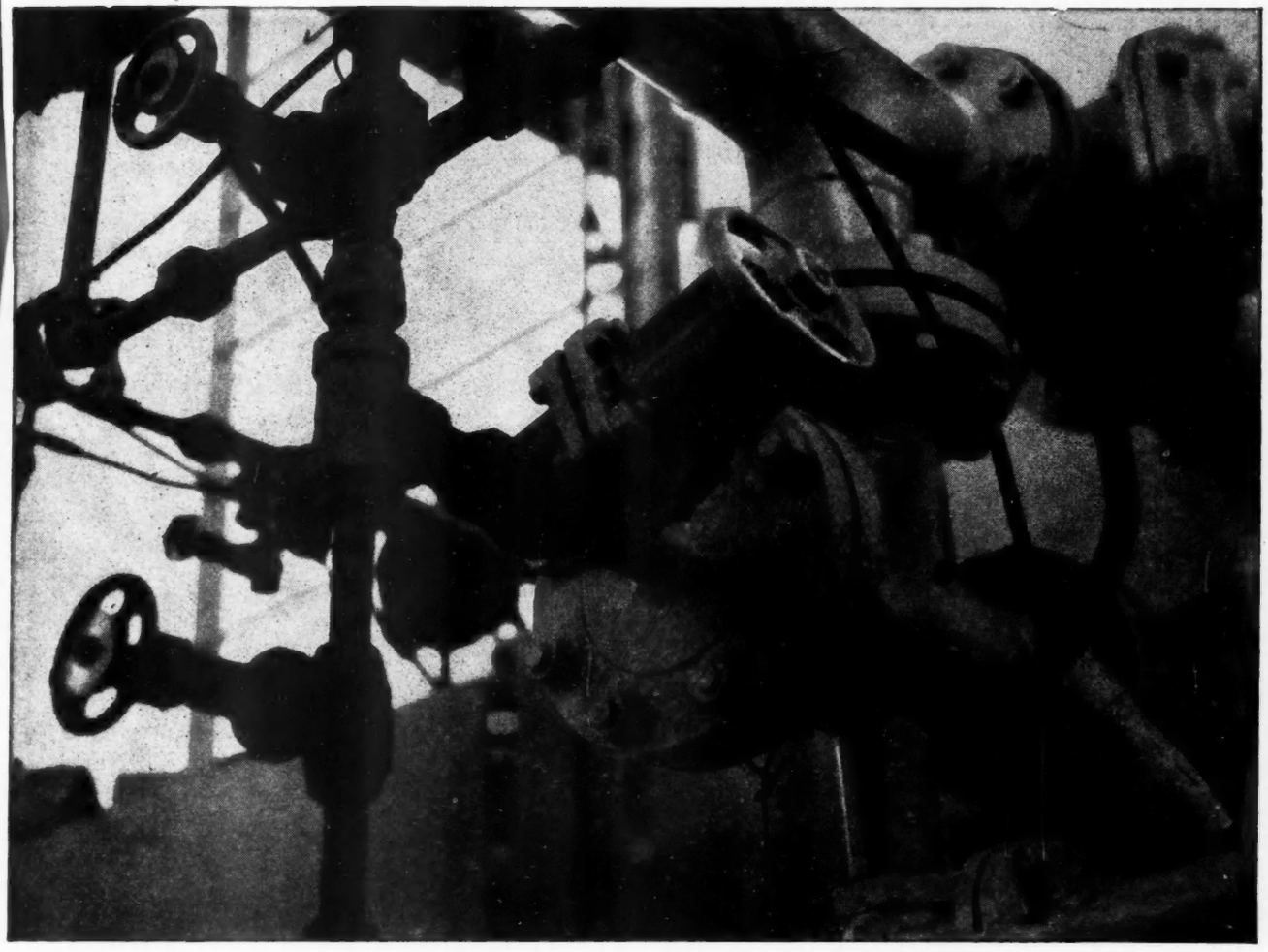
It has the advantages of replacing operator skill with accurate instrumentation, delivering a strong jarring action, providing accurate determination of line pull, being easy to rig up and tear down, and is light and highly mobile.

The unit is designed for use in connection with permanent-type well completions for pulling, running, installing, and removing from a well numerous tools used in production operations, for swabbing, and is adaptable for performing a number of surveys for determining a well's characteristics.

Designed to provide a complete and efficient wire line service in a compact space, the unit is mounted on a one-ton truck. The body is fabricated with room for equipment and tools without clutter. Doors in the sides permit access to all tools. Small and extremely mobile, the truck assures substantial saving in the time required for moving on a location, rigging up and tearing down equipment for a job.

To provide this maneuverability, aluminum is used whenever possible in the fabrication and construction of the truck and accessories, to take advantage of the 60 percent saving in weight over the use of steel. The base of the truck is aluminum and has a double floor, permitting storage of the lubricator, gin pole, and other long tools, between the floors.

The shelves, bins, lubricator, and the bottom section of the gin pole are aluminum. The lubricator and gin pole are light in weight and are designed for ease in handling. One of the first aluminum wire line reels is used, with reel frame and cover of



Valve of HASTELLOY alloy B, above, and others of the same nickel-base alloy installed in Shell Oil Company's refinery at Wood River, Ill., to assure adequate resistance to strong corrosives.

Where steel valves fail in a day... "HASTELLOY" alloy B lasts indefinitely

HANDLING SULPHURIC ACID (pH 2–5) on one side and live steam on the other, the valve in the center, above, lasts indefinitely . . .

Why? Because it's made of HASTELLOY alloy B, one in a series of nickel-base alloys produced and sold under the trade-mark "HASTELLOY", by Haynes Stellite Company, a Division of Union Carbide and Carbon Corporation, Kokomo, Indiana.

The valve illustrated serves the neutralizer unit in a large refinery. A carbon steel valve previously installed lasted only *one day*, which indicates the severity of the service.

This refinery also uses valves of HASTELLOY alloy B on a reboiler that recovers antimony trichloride and aluminum chloride. And, pumps of HASTELLOY alloy recycle the corrosive catalyst. At the bottom of a light oil treater in this refinery, you'll find a valve of alloy B handling sulphuric acid at varying strengths and temperatures up to 120°F.

Despite corrosive chemicals and live steam, these valves of nickel-base alloys, in most instances, last indefinitely without leakage.

Give your tough jobs to a HASTELLOY alloy or some other high-nickel alloy that you know will resist strong corrosives.

Whatever your metal difficulty, let us give you the benefit of our wide practical experience in this field. Write for List A of available publications. It includes a simple form that makes it easy for you to outline your problem.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N. Y.

WIRE LINE SERVICE TRUCK . . .

Electronic 2000-pound weight indicator assembly consisting of hay pulley, converter, connector cable and weightometer.

the same lighter, corrosion-resistant metal. The interior of the truck is aluminum paneling, easy to clean and maintain.

The lubricator is made in three sections, two of which are eight feet long, and with a third section four feet long. Made of 24 ST aluminum, it has a working pressure of 4000 pounds per square inch and a test pressure of 8000 psi. It is made up by using steel quick union, O-ring connections. The unions are made up on the lubricator only once, with steel to steel connections wherever the lubricator is assembled. The construction and weight of the lubricator join to make it easy to assemble and set up on the tree.

Powered by two hydraulic motors rated at 21.8 horsepower each, and fed by a similar unit which acts as a pump and operates from a power take-off from the truck transmission, the motors are connected in such a manner that full torque is provided when both motors are in use, or half the torque and twice the speed when only one motor is operating.

This can be compared to the automatic transmission for control of the low and high speed on a modern automobile. The ease of obtaining either torque or speed is much the same. The motors will deliver a line pull at the surface of 1600 pounds maximum torque and will retrieve the tools from 12,000 feet at the rate of 1200 feet per minute.

The hydraulic control system is designed to permit the truck operator to reverse the motors instantaneously while running at top speed. This design is essential to "jar down." By setting the controls with both motors running slowly to pick up the tools, all the power fluid is going through both motors, which deliver full torque. When the "pick-up" point is reached, the four-way valves are pushed forward, reversing the direction of the fluid and the motors. As the valves are reversed, one is blocked to prevent fluid from entering the right hand motor.

This in turn directs all the fluid being pumped to the remaining motor and provides the immediate high speed necessary to spin the reel and drop the tools. On a normal job, the operator is able to throw controlled slack in the line allowing the tools to drop free. The needed speed is easily adjusted by setting the valves and throttle before beginning operation.

These innovations allow the vehicle to be used to "jar down" with a controlled severity never before obtained by either mechanical or hand means. The skill and stamina of the operator, as well as operator fatigue, have been replaced by the power controls.

In the manner of a well logger, the operator sits inside the truck facing a control panel. Dependence on an operator's skill has been largely replaced by sensitive instrumentation, and operator training time has been considerably reduced. The "feel" of the line is visible, and the operator never touches the wire line. The control panel has a tachometer, a hydraulic pressure gage, a hydraulic oil temperature gage, an ammeter, a hand-controlled throttle, two four-way valves, a throttling valve, an odometer, and an electronic weight indicator.

The throttling valve is so arranged in the circuit that it may be used as a hydraulic brake in lowering tools in the hole. This is an added safety in case of obstruction while going in the well at high speeds.

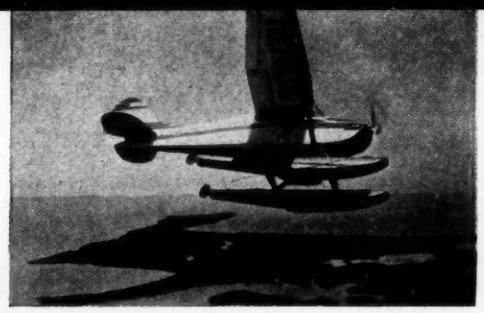
The use of hydraulics in designing this unit gives great safety in coming out of the hole at high speeds, because in case of obstruction, the reel will stall out at the torque set by the operator. This circuit acts as a fluid clutch, which will slip at the preselected torque.

The heat exchanger for the hydraulic fluid is mounted in front of the truck radiator and consists of a system of finned tubes manifolded together so that fluid passes into one side of the tube, across the tube, is cooled, then out the other side. The system is designed with a valve arrangement that permits the truck operator to pass all the fluid through the tubes for cooling or allows him to pass the fluid directly from the pump to the motors, so that no power is lost in friction in the heat exchanger. This will give added power or speed to the reel in an emergency.

By modifying existing designs and developing new ones, a number of necessary wire line specialties have been developed for this unit — line wipers, measuring line stuffing box, wire line control head, electronic weight indicator, blowout preventer, and wire line jars — representing a

Permanent-Type Well Completions

ERVICE-ABILITY



When you call Tretolite for service, you get it — fast. This ability to provide effective service is dependent on many factors. It requires trained personnel, strategically located and adequately equipped. It necessitates the provision of dependable, fast transportation.

At Tretolite we believe we have the men and facilities to provide the best demulsifying and corrosion control service obtainable. We hope you will prove this to your own satisfaction. Just call the Tretolite service engineer in your area — you'll get service, fast.

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TF 55-2

concrete advancement in this field. Through skilled engineering and thorough experimentation, cheaper and lighter equipment has been made to meet the specifications for this type of wire line service.

The electronic weight indicator is one of the most unusual features. A complete 2000-pound weight indicator assembly consists of hay pulley, converter, connector cable, and weightometer. A converter, attached to a sheave wheel onto which the wire line is strung, receives strain put on the line and converts this load into electrical intelligence. The connector cable transmits this intelligence to the weightometer, where it is indicated on the weightometer dial. The cable, which is approximately 100 feet long, is the only connection necessary from the wellhead to the operator's position. This weight indicator has been found drag free, sensitive, and rugged in the field.

The weightometer dial is calibrated to be read in this manner: the dial reading, multiplied by 100, gives the actual weight in pounds of the load on the wire line. No other correction factor is necessary. Low range on the dial indicates strains from 0 to 1000 pounds; High range, from 1000 to 2000 pounds. Either range can be used as necessary by merely switching the range knob from high to low, as indicated by the strain on the line.

Hydraulic Jar. The most acute problem of a hydraulic wire line service has been to provide a powerful upward force at the bottom of the hole. The old solution for a bad fishing job has been to jerk with tremendous speed on one end of an extremely flexible line and 10,000 feet away — with flexibility and friction working against the operator — to deliver an upward blow on the tools in the well.

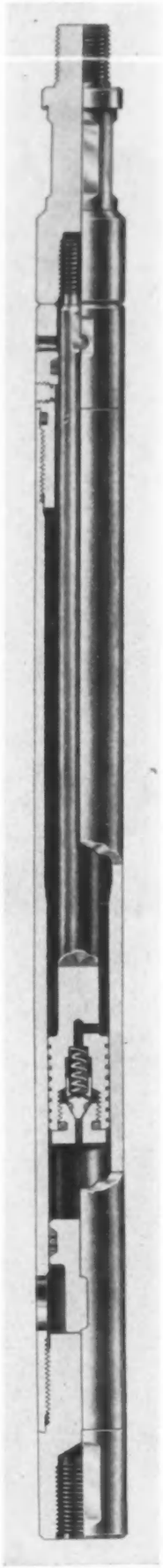
To improve this system, it was decided to use some type of mechanical or hydraulic jar, such as those used in the drilling industry, to deliver the energy at the problem point of the tools in the well. The hydraulic drilling jars, reduced for tubing size, with light lines and with weight bars not exceeding 60 or 70 pounds, were used in experimental wells. They were found to lock under hydrostatic pressures that exceeded 800 psi. If they went into the well in a collapsed position, they could be operated at a depth of 1700 feet only once, for they would then lock and the light weight bars could not collapse them to deliver another blow. At this point, a balancing piston was incorporated in the design and solved the problem by furnishing a powerful and practical tool.

The hydraulic wire line jar has been used to good advantage in virtually every type of wire line operation. Bad fishing jobs, seemingly impossible with old methods, have been cleaned up with this new tool.

The jar uses an improved hydraulic system which enables it to strike with whatever force is desired—within very wide ranges—from a very slight blow to a blow of great force. This wire line jar can be retained on the line at all times when conductor line is not required, assuring the ability to jar immediately should equipment stick. The tool can be employed to advantage in any conceivable retrieving capacity.

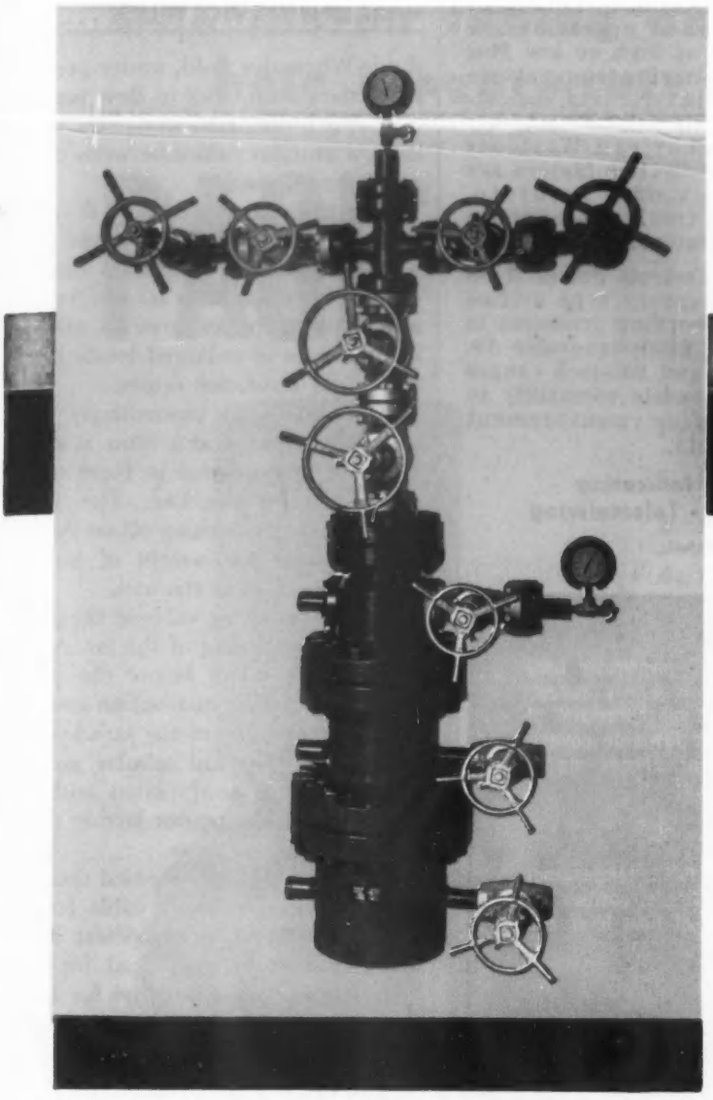
Field tests have established still another advantage of the combination of fluid clutch, or throttling valve, and hydraulic jars. When extreme differentials exist in the bottom of the well, the operator can set the hydraulic circuit with the desired pull on the line, and with the reel ready to move automatically with instantaneous speed up the hole when the hydraulic jars deliver their lick, pulling the tools from their seat or seal. The differential pressure that would normally have created a fishing job by blowing the tools up the hole is not a hazard when the tools are automatically speeding out of the hole at 1200 feet per minute.

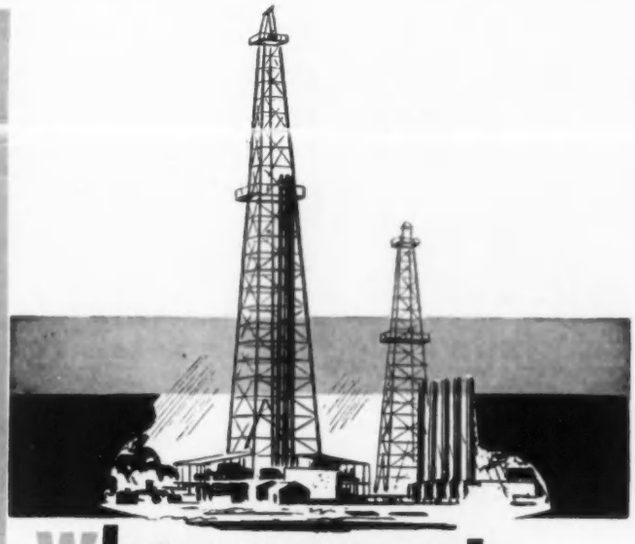
Sturdy and powerful in construction, the jar consists essentially of a sliding mandrel within a hydraulic chamber. When in closed position, a piston on the lower end of the mandrel rests in a restricted cylinder. As a strain is taken on the line the top sub and mandrel are pulled upward, moving the piston through its cylinder against the resistance of hydraulic



Cross-section of hydraulic wire line jar.

Permanent-Type Well Completions





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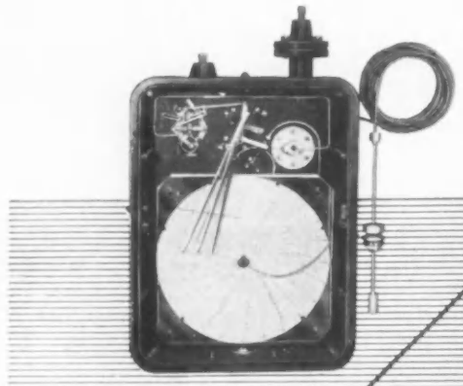

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WIRE LINE SERVICE TRUCK . . .

fluid. When this fluid, under pressure from the piston, tries to flow past the piston, it is restricted in its flow to the narrow annular orifice between piston and cylinder wall.

This close fit retards fluid flow and delays completion of the stroke until a strain sufficient to strike a blow of desired force has been set up. As soon as the piston passes from its cylinder into an area of enlarged inside diameter, fluid resistance ceases.

The tool then immediately completes its stroke and a blow is struck which is proportional in force to the strain put on the line. The jar is closed again by slacking off on the line and allowing the weight of jar and sinker bars to close the tool.

A one-way check valve in the piston permits easy closing of the jar. A sliding balance pistol below the piston provides volume equalization essential to the functioning of the jar's hydraulic system. Standard tubular jars are always run in conjunction with the hydraulic jars to permit jarring down, and in emergency use.

This tool logically created the need for a heavier, stronger cable for the truck to deliver greater power at the work point. Where flexibility and lightness of line is essential for hand-operation, strength is the primary factor for hydraulic operations. Heavier lines were easily used in this new truck, for line weight is not a problem with power controls.

The wire line control head was developed as an aid to running wire line tools in the hole under considerable fluid or gas pressure. This tool is actually a line wiper with a pressure-reducing device built in. In a number of exacting field tests, this item has completely lived up to expectations.

The tool actually reduces pressure within itself to the extent that the grip on the line rubbers on the line can be relaxed, thus the wire line tools can be run in under a given well pressure with considerably less weight required to lower the string than could be otherwise possible.

Fewer sinker bars are required, which often permits use of a shorter

Permanent-Type Well Completions

One piston tubing anchor keeps tubing in hole longer—cuts well pulling costs

PAGE* TYPE R TUBING ANCHOR

1. ***ONE PISTON TUBING ANCHOR***
2. ***PISTON PROTECTED AGAINST WELL EFFLUENTS***
3. ***PROPER DISTRIBUTION OF POWER TO CASING***
4. ***FIXED SLIPS ELIMINATE GYRATION***

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WIRE LINE SERVICE TRUCK . . .

lubricator. The wire line control head is made up on the line above the operating tools and is made up on the lubricator in the same manner as a line wiper. Pressure reduction takes place in a special flow tube.

When fluid enters the reduced ID of this tube, its volume is sharply reduced; then the fluid flows into conically-shaped turbulence chambers in the tube. There the steady flow of the fluid is interrupted and an erratic, turbulent flow occurs which causes considerable pressure drop across the tube. The volume of fluid or gas, thus reduced to an acceptable minimum, is carried off through a flow hose. By closing down a needle valve on the flow hose, more well pressure can be applied to cause the line rubbers to grip the line and act as a breaking element, facilitating control over the line as it is being brought out of the hole. A spray guard mounted on top of the tool has a drain hose to carry off any excess fluid which might escape through the rubbers.

The blowout preventer is manually operated to bring pressure from two opposing rams against the line to give positive protection against blowouts.

Wire Line. Much experimentation in the use and adaptability of different wire lines under a wide range of pressure conditions, has gone into the choice of a line for this truck. Initially an .072-inch diameter line was used when pressure on the stuffing box prevented using the heavier stranded line. It was good enough for most field work but occasionally, in a hard pulling job, the hydraulic jars would pull it from the rop socket.

The larger .082-inch line was used with more success, but it did not withstand the constant heavy jarring of the hydraulic jars. Now in use, the .092-inch line has proved successful for full wire line operations, including swabbing. A pull of 800 to 1200 pounds is used on it at all times to operate the hydraulic jars.

By using a divided reel, two lines were employed. With the single strand wire on one side, the other side was used for stranded cable. Originally, a 1 x 19 stranded, ⅛-inch aircraft cable was used. This cable had a breaking point of 2950 pounds and was used for approximately six months. It was found that the wires or strands were so small that they wore easily and consequently broke.

When this happened, the line would "ball up" at the stuffing box and the lubricator would have to be taken down to remove the obstruction before the tools in the hole could be moved.

In aircraft cable construction, the individual strands are welded at different spots. This caused a "bird caging" effect or separation of the strands after a pull had been put on the line. A 7/64-inch, 1 x 19 stranded line was tried with much the same results.

At present, the .092-inch line is being used on all jobs, but research is being directed toward securing a stranded line that will take the wear and have the flexibility of the single strand line. The additional strength and the load safety factor of a multiple strand are needed.

The use of only one line will reduce the weight and inertia of the reel. At present, the .092-inch line is most practical, for in three months of severe service, it has not crystallized. Larger sheaves or pulleys at all points of cable contact, including the odometer, are being installed to reduce the tendency toward crystallization at wear points.

A testing panel is mounted on the truck for servicing all types of retrievable gas lift valves. A nitrogen tank with a capacity of 80 cubic feet at a pressure of 2200 psi is mounted under the truck. Copper tubing connects the tank to a pressure regulator and to the valve tester.

Minor repairs, as well as valve testing, can be performed by the truck operator. This eliminates the usual service call and mileage, as well as saving production time and wire line operating time, through this "on location" testing and repair service.

—The End

Permanent-Type Well Completions

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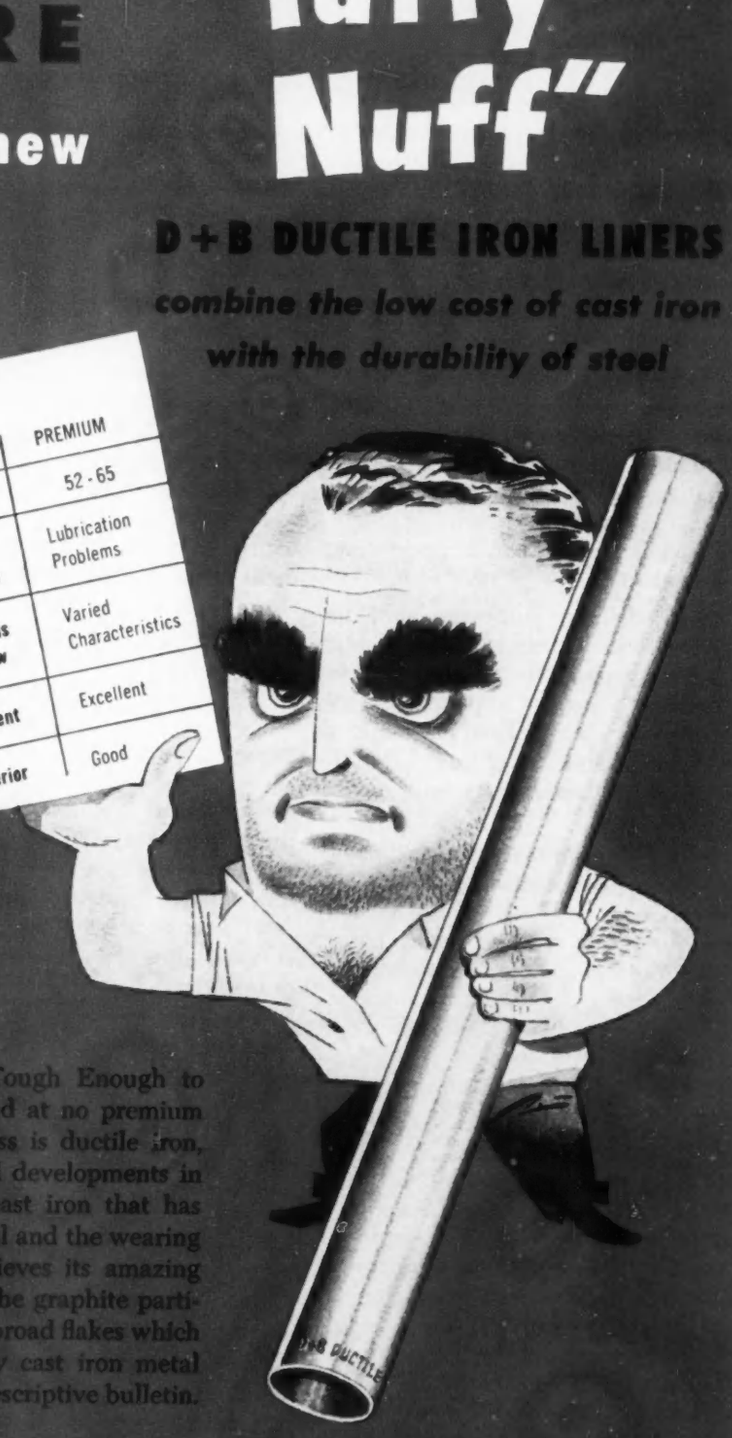

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Corrosion Mitigation Will Pay Dividends Offshore

It is mandatory that accurate records be interpreted into dollar values to provide management with proof of what preventive measures achieve.

By WARREN D. PALMER,
Protective Coating Engineering and Inspection Service, Houston

PRACTICALLY ALL the offshore platforms, servicing fleet and other equipment are constructed of steel. Therefore, nearly all such marine installations are subject to corrosion. Since the total investment in these facilities is tremendous, corrosion becomes a serious problem.

Many drilling platforms built in 1950 or prior were installed without cathodic protection and with little or no attention given to painting. Corrosion of such installations has resulted in a considerable loss of money due to necessary replacements and repair expense.

In an effort to overcome such loss, to protect their investments, and to reduce interruption of production from bay and offshore wells, many companies now employ their own engineers, research chemists, corrosion and other specialists. They often work with special consultants to find effective ways to produce oil better, faster, longer and at the most economical cost.

Protection from corrosion of these marine installations with effective paints and protective coatings is an example of the payback which is a direct result of thorough investigations and sound planning. Today, very promising results are indicated in the prevention of corrosion by the use of monel sheet metal bands at the splash zone, effective vinyl paint coating systems above the waterline and the installation of cathodic protection below the water level.

Prevention of corrosion is not easy or simple. Many mistakes have been made and are still being made concerning painting. Company management first must be shown that a problem exists; that the company is losing money, and how much money, each year due to corrosion. Then it must be proven that it is economically sound and profitable to practice effective corrosion control. To show these proofs to management, to get these costs and savings figures, it is mandatory to have records based on past investigations and evaluations or results obtained from similar work by other companies practicing corrosion control.

Dollar Data. Engineers, chemists, etc. must interpret and always reduce their findings or results of investigations into dollars and cents for management. Technical details are fine for the corrosion engineer's own records, but they only clutter up a report to management. They also must transfer their data into working detail drawings, specifications and instructions for those who will actually carry out and direct the program to be put into effect. They also must provide someone capable of selling all personnel involved on the importance of the program and the effectiveness of his job toward the program's success. The program must have constant supervision and control. Troublesome details, imperfections, revisions and improvements must be handled promptly, quietly and effectively.

It isn't hard to understand that a scientist, or engineer, either experienced or not, may easily become so overworked doing investigation, experiments, keeping cost records due to corrosion, unnecessary repairs, condition and location of equipment and a multitude of other seemingly important details that he has little or no time to evaluate results in terms of past records, or dollars and cents.

Many fail to keep constant detail cost figures and notes. Often, they get so involved in their work that they even fail to sell management on the importance of their job and the fair salary it should be paying. There are many duties, investigations and details which do not seem important. But, when the costs and savings are tabulated the result may be astounding. Likened to the leaking water faucets which cause the water bill to be excessive, a little time, an insignificant cost, for material will eliminate the leak and excessive water bill. Someone must do the work or take necessary steps to get a program put into effect and get the job done.

It takes time. Every single item to be accomplished takes time, expenditure, experience, training, selling and a lot of hard work, not necessarily in an air-conditioned office with a beautiful secretary. However, the importance of typed records, reports and information properly duplicated and filed cannot be overstressed.

It takes a great deal more money to put a corrosion engineer to work than just his salary, insurance and old age benefit. He must have a place to work suitable for the tasks expected of him. He must be made acquainted with the duties of his job, what his responsibilities are and the limits of his responsibilities. He should be properly introduced to other employes whose cooperation and support he will need.

The newly-hired corrosion engineer will need suitable tools, special equipment, supplies, a helper to take care of detail work and time before he can produce results. He must be assured that his job has a future, and that the results of his labor, knowledge and experience will be suitably rewarded by salary increases and increased importance of his position. The company and his direct supervisors should always express a personal interest in him as an individual as well as the work he is doing.

It is human nature to hope to get everything in one package at a reduced price. By the same token, management usually expects far too much and too soon, from the engineer working on its problems. He is expected to be an expert in every field—corrosion,

metallurgy, plastics and paint; an electrical, mechanical, chemical, civil and petroleum engineer; plus an assistant to everyone.

But the solemn fact is that there is a great deal he does not know and a lot more which he is not sure of. He realizes this handicap and he and his fellow workers will profit if he is not forced—or encouraged—to bluff and "pass the buck." It is just as important that information, trends, expectations, cost and impressions should be channeled to the corrosion engineer as it is for the engineer to report his time, results and work in progress to management. An easy flow of information in both directions—not just one—makes for close cooperation and good morale.

Management can help. Management can give the engineer guidance. It can supply him with tools, equipment, help and special consulting services in particularly important specialized fields. It can—and should—impress upon him that the company expects him to furnish its management the best, faster, and for the least amount of money.

But, whether it be equipment he is recommending for purchase, a major repair contract, the need of a specialized consulting service, or other need which will require immediate or special handling, management must make the engineer feel free to base his decisions and recommendations on that which is best or most economical for his company.

Following are a few consultative and specialized services which the corrosion engineer may find potentially profitable for his company:

1. Laboratory analysis of corrosion products, metals, materials and the like.
2. Corrosion—rate investigations and study of test coupons.
3. Supervision and inspection of concrete pours, welding, painting and special testing (hydrostatic, X-ray, "holiday" detection, etc.).
4. Equipment design.
5. Production specialists.
6. Water treatment and other forms of corrosion control.

The superintendent and engineer who are faced with any of the above or similar problems will realize the need for the help of those who specialize in particular fields of study—but

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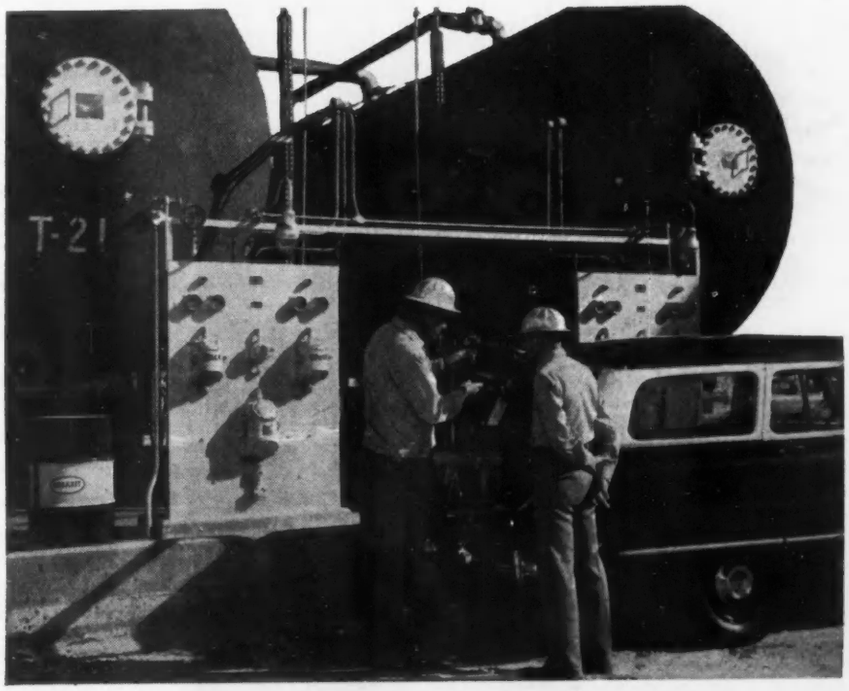

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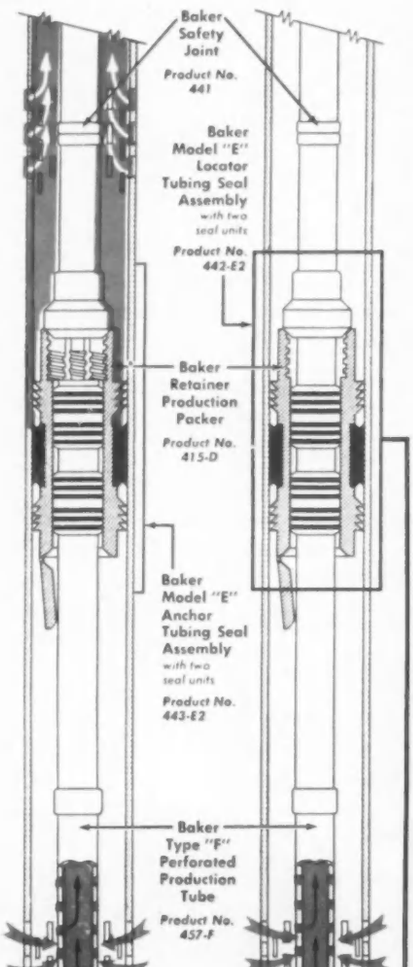
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Baker Model "E" Locator Tubing Seal Assembly with two seal units
Product No. 442-E2
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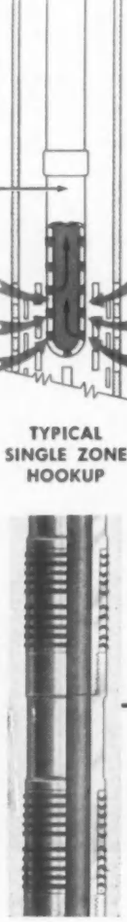
TYPICAL DUAL ZONE HOOKUP

TYPICAL SINGLE ZONE HOOKUP



Right: Picture shows actual detail of seal units

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A single Baker Retainer Production Packer will also outperform many specialized tools when used as a TESTING PACKER – SQUEEZE PACKER – GAS LIFT PACKER – PERMANENT COMPLETION PACKER – WATER FLOOD PACKER – GAS INJECTION PACKER – CORROSION CONTROL PACKER – TUBING ANCHOR – ONE-WAY BRIDGE PLUG – PERMANENT BRIDGE PLUG.

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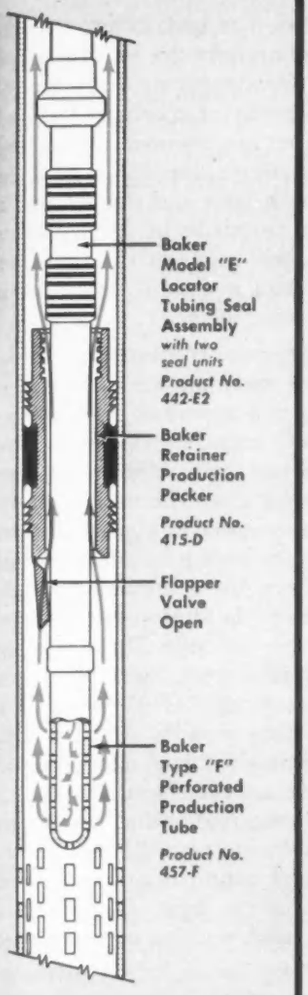
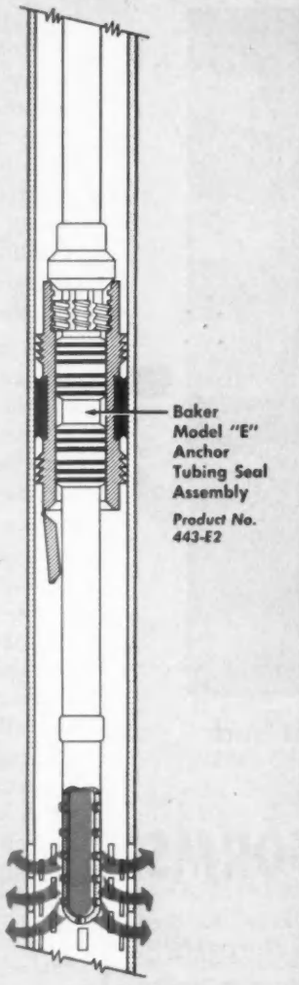
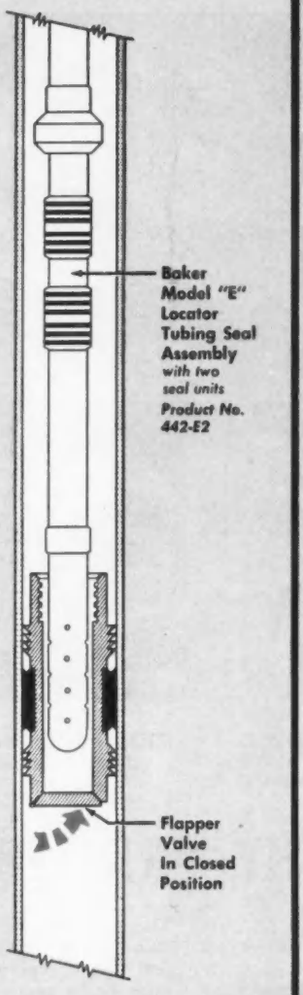
HOLDS PRESSURE DIFFERENTIALS FROM ABOVE OR BELOW—Two sets of opposed slips, and a resilient packing confined by lead and metallic sealing rings, effect a permanent pack-off that will hold any pressure differential *either from above or below the packer* that is safe for the well equipment.



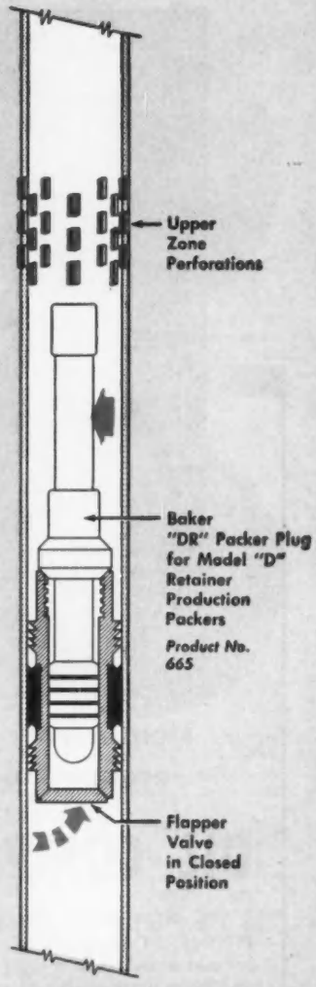
Washing or Circulating—Seals of Locator Tubing Seal Assembly removed from packer bore. Flapper Valve held open by tubing extending below the Packer.



Pressuring Below Packer—Acid or cement squeeze, formation fracture, gas or water injection. Anchor Tubing Seal Assembly is used when high squeeze pressures are required.



Isolate Zone Below Packer—Tubing String removed, Flapper Valve closed. Isolates pressure differentials (squeeze, production) from below the packer.



Temporary Bridge Plug—For working over zones above the packer. DR Plug is run in on Baker Retrievable Cementer and retrieved with overshot.

PACKS-OFF AND HOLDS UNDER HIGH BHT—Baker Retainer Production Packers will hold high pressures under conditions of high temperatures. Hundreds of Baker Packers are in successful service in Southwest and Gulf Coast areas where temperatures in excess of 300 degrees are not uncommon.

RESISTS CORROSION—The cast-iron used in the construction of Baker Packers is far more resistant to corrosion than the casing in which the packer is set, thus making it ideal for permanent installations, or for use in areas plagued with a severe corrosion problem.

EASILY DRILLABLE—The Baker Packer is constructed of drillable cast-iron, and its design supplements the breaking-up action of the bit. Whether it has been in the well for only a few hours, or for ten years, the Baker Packer can be drilled up in minimum time. Expensive and hazardous "milling-out" operations never are required.

IMPORTANT FACTS

Baker Packers are used in a majority of installations where conditions of extreme pressure, temperature, or depth are present. Baker Packers also dominate Dual Zone installations, particularly those involving two-packer, crossed-flow arrangements.

BUT IT IS ALSO TRUE that *more* Baker Packers are used for *simple single zone* completions than for *any other type of completion,* and that *most* Baker Dual Zone installations employ *only one* packer.

Ask any Baker representative, or office, for complete details. There is no charge, and no obligation, for specific recommendations and completion planning advice available from Baker Technical Advisers. Why not be prepared for your next completion?

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not until he has had to approve the appropriation, pay the bills or be responsible for attempting to do the job without benefit of specialized knowledge. To get management to this realization means a selling job, well-documented with facts and figures and as devoid as possible of technicalities. Feeding them generalities without concrete data is almost a sure bet to get the project denied.

It takes considerable research, investigation and time for the engineer to obtain and assemble definite conclusive data regarding savings or pay-outs resulting from various corrosion control programs. Though such conclusive information is highly desirable and often essential in order to sell management, there are many conditions where the losses due to corrosion are sufficiently high to justify trying something new or some control measure just on possible merit. It is true this may well be called a trial and error method and maximum effectiveness at the most economical costs may not result. But the failures as well as the success will result in conclusive information if proper records are kept up to date. If nothing is risked or tried, nothing will be gained or learned.

It is therefore obvious that management should place their confidence in the engineer's judgment, experience and knowledge. Also see that sufficient capital, time and authority are made available to permit the engineer to do his work properly.

Large companies, with millions of dollars invested in plants and facilities subject to corrosion, may well afford the creation of a staff to make the necessary studies and assume control of the problem. Even so, such organizations often must rely on outside consultants for guidance and to expedite results.

Smaller companies and those having investments scattered over a wide area may not be able to justify the expense of setting up a fully staffed corrosion control group. However, corrosion losses will exist, whether it is a tin gutter or a million-dollar unit, and some means of controlling corrosion are necessary. It is essential for such companies to employ either its own staff or a consultant capable of and dedicated to solving the problem.

Here are some of the ways in which

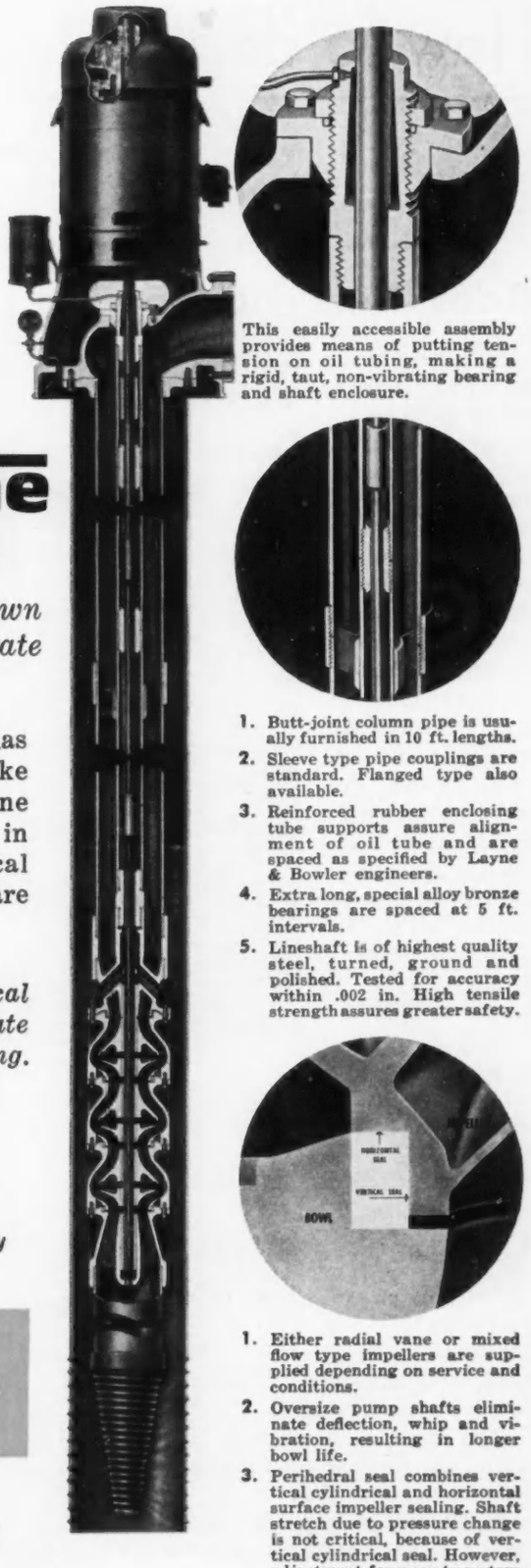
outside consultants can be of great benefit to an organization:

1. Help sell a mitigation project to solve a problem.
2. They can provide the latest information and experience from solving many other industrial problems to bear on a specific problem. Perhaps this apparent "puzzler" has already been met and solved elsewhere.
3. They have specialized equipment to help in the investigation which might be too expensive for a single plant to justify.
4. They relieve the customer of having to recruit or train a staff of specialists and provide all needed supplementary personnel.
5. They have the advantage of the unbiased viewpoint of a complete "outsider," and are not restricted by inter-company personnel relationships.
6. A company can thus employ the "old head," with his wealth of experience, without the disadvantages often imposed by company insurance and pension plans.

Such a staff or outside consultant may be a corrosion engineer, chemist, plant engineer or production superintendent. Regardless of title, the individual or staff must keep informed, recognize the problems as they develop and be able and permitted to do something about them. Data required for the best solution involve the gathering of information, especially cost figures, and conclusions after study.

The most important job then is to present the complete picture to management along with a well-documented request for the required appropriation. When the project is approved, the money must be spent wisely and effectively.

But doing the job is not the end. Keep accurate records of what was done and why. Follow up with appropriate inspections to see how well the work has stood the effects of time. Then present these figures to management, along with the best possible estimate, if accurate data are not available, of what it would have cost if this work had not been done; being as specific as possible. Keep this information handy, if only to remind management later of what results were achieved when a similar project comes up in the future. This is the best salesmanship of all; that of positive achievement. —**The End**



This easily accessible assembly provides means of putting tension on oil tubing, making a rigid, taut, non-vibrating bearing and shaft enclosure.

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PUMPS
are economical to own
— economical to operate

Feature after feature has been designed to make the Verti-Line Turbine Pump today's best buy in vertical pumps. Typical construction features are illustrated.

Whatever your vertical pump needs, investigate Verti-Line before buying.

1. Butt-joint column pipe is usually furnished in 10 ft. lengths.
2. Sleeve type pipe couplings are standard. Flanged type also available.
3. Reinforced rubber enclosing tube supports assure alignment of oil tube and are spaced as specified by Layne & Bowler engineers.
4. Extra long, special alloy bronze bearings are spaced at 5 ft. intervals.
5. Lineshaft is of highest quality steel, turned, ground and polished. Tested for accuracy within .002 in. High tensile strength assures greater safety.

1. Either radial vane or mixed flow type impellers are supplied depending on service and conditions.
2. Oversize pump shafts eliminate deflection, whip and vibration, resulting in longer bowl life.
3. Perihedral seal combines vertical cylindrical and horizontal surface impeller sealing. Shaft stretch due to pressure change is not critical, because of vertical cylindrical seal. However, adjustment for wear to restore original capacity is easily accomplished by means of an adjusting nut in the top of the driver that brings into action the horizontal part of the Perihedral seal — an exclusive Verti-Line feature.

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How to do it

PRODUCTION HINTS

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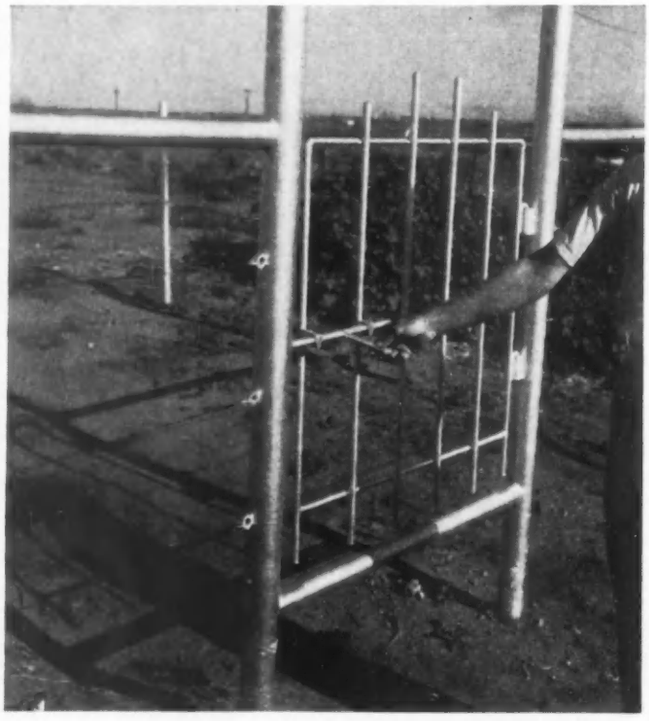
Rods, Nuts and Pipe Rig Location Fence



Location fencing, a never-ending headache to the operator, often follows a pattern of temporary rigging which requires constant maintenance or utilization of more expensive commercially-constructed enclosures. Here is a fence that will not fit into either category but, at the same time, does provide a sturdy, trouble-free enclosure.

Step number one in building this fence consists of selecting junk, but usable sections of 2 and 3-inch line pipe. Two-inch fence posts are cut to lengths of six or eight feet, depending upon the consistency of the soil in the vicinity. Sandy soil will require longer posts for secure anchorage, while gumbo calls for shorter posts. After the posts are cut, four junked ⅜-inch nuts are spot-welded on opposite sides of the posts. The nuts are welded approximately a foot apart, while the upper nut is located near the top of the post. After each post is driven or cemented in the proper location, particularly in areas where heavy rain fall prevails, a short wooden plug should be countersunk in the post opening and the pipe capped with cement. This procedure will eliminate rain water accumulating in the post and causing rapid deterioration.

The gate frame is made of 3-inch line pipe or tubing fabricated to provide for a seven-foot extension above ground. A horizontal spreader is welded atop the two posts to insure needed reinforcement. The gate frame is given additional reinforcement with the welding of a 2-inch pipe spreader approximately 1 foot off the ground.

Lengths of 2-inch pipe are cut to fit between the gate frame and the first fence post on either side of the frame. By welding these horizontal braces atop the fence post on either side of the frame and also to the frame, the over-all fence system is given maximum strength. Corner posts are reinforced in a like manner.

Two short pipe nipples, with an I.D. slightly greater than the O.D. of the rod used in gate construction, are welded to one of the frame posts to facilitate hinging.

The actual gate construction consists of forming the outer member in a U-shape, then vertically stripping the frame with rod of comparable size. The hinge pins are made of two U-shaped sections of rod, one side being connected to the gate while the remaining pin drops into the hinge nipples welded to the pipe gate frame.

Two short extension bars with a nut welded on the end, a rod of smaller O.D. than the I.D. of the nuts, forms the gate latch. A hole is burned in the gate frame to engage the latch. For latching convenience, a short rod is welded at a 90 degree angle to the bolt assembly.

Use Bucket Stand to Aid Parts Washing

A tripod stand for holding a wash pail saves time and effort when washing small parts in solvent. In addition, the bucket and solvent are kept handy for the next job.

The stand is made from ⅝-inch sucker rod welded as shown. Three lengths of rod, bent to the proper size, hold the bucket. The larger ring should be sized to fit just beneath the rim; the second, to fit near the bottom. The third ring acts as a brace. Legs are cut to a length so that top of the pail is about 30 inches high.

Inside the bucket is a removable false bottom made from 1/16-inch tinner's metal. It allows dirt to settle out of the solvent. A lid cut from tinner's metal keeps solvent clean when not in use.

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To get your wells producing fast, call your Butler distributor —and get years of tight, clean crude storage.

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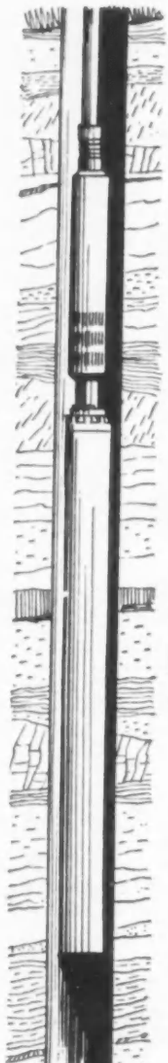

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With continually rising labor and investment costs, economy of operation is of paramount importance in producing wells with decreasing oil-water ratios.

Reda pumps are given consideration as original or replacement equipment because of their known performance in producing fluid at a *lower* cost per barrel, thus often extending the ultimate economic life of wells.

Improved engineering and design have increased operating life. Increased operating life means *lower* labor cost per barrel, *lower* investment cost per barrel, *lower* maintenance cost per barrel: *lower cost per barrel produced.*

REDA

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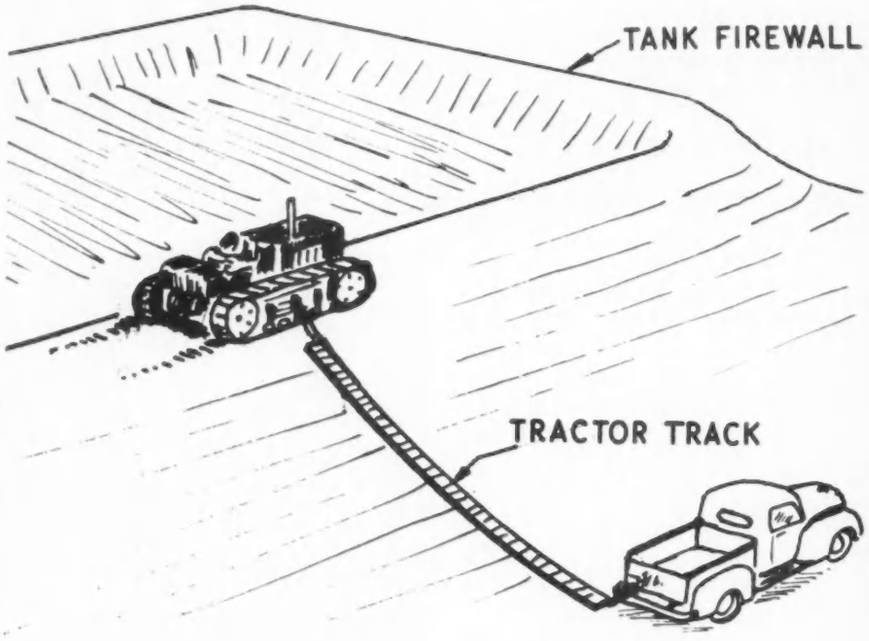
HINTS . . .



Use Tractor Track to Smooth Firewall

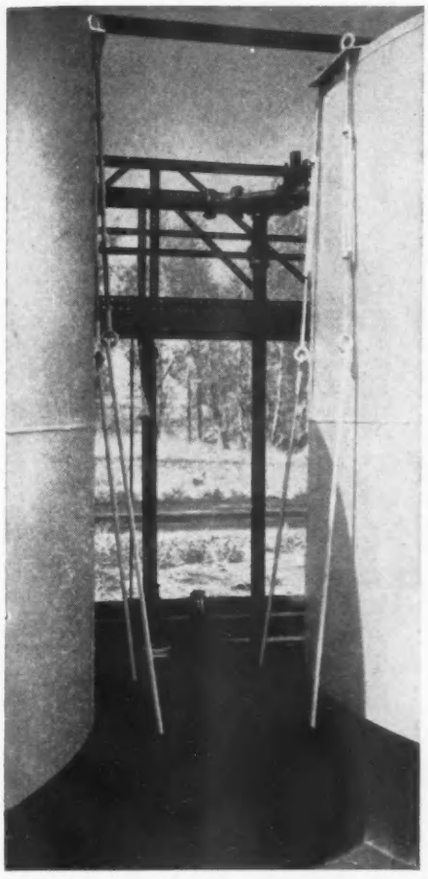
Taking an idea from concrete finishers who often use belts to fine grade concrete, one contractor uses a tractor track to drag the side of a firewall. This saves a great deal of hand labor and gives a better job.

The top end of the track is hooked to the side of a tractor and the lower end is hooked on to a pickup truck. With the tractor leading, the two pull the track around the firewall several times. Then the tractor drives down the slope.

A man with a shovel can obliterate the tractor tracks easily, and the firewall is "polished."

Old Tires Prevent Damage to Concrete

When necessary to move a heavy crawler tractor with cleated treads across a concrete road, lay old, discarded tires ahead of the treads to prevent damage to the concrete. The tractor can move on the tires without the treads nicking or chipping the surface of the road.



Anchors Prevent Tanks From Floating in Low Areas

In areas where flash floods are likely to occur, a simple precaution will prevent tanks from floating and breaking out pipe line connections.

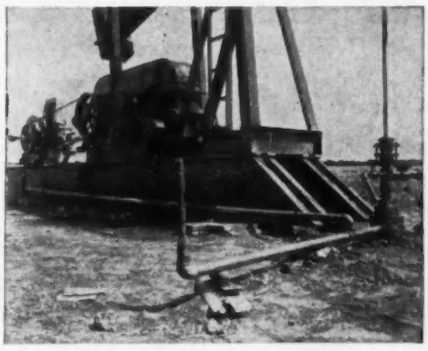
Before the tank grade is built, dig a trench and place a 6-inch pipe between each tank and at the ends of the tank battery. Lower the pipe into the trench and cement it in place. Use sucker rod material to make the hold-down anchors and place a turnbuckle at the top of each for adjustment. Weld a plate with holes in it for tops of the turnbuckles to the top edge of tank above the dead men.

After the tanks have been set, fasten the anchor rods to the dead men and take up the turnbuckles so the tanks cannot move.

Discarded Standing Valve Serves as Relief Valve

When gas from the casing head is used to run the engine on the pumping unit, a simple way of preventing buildup of back pressure on the sand face is to use the standing valve from the bottom of the working barrel. A discarded valve may be used. A small amount of pitting on the seats or a worn cage will not make any appreciable difference in back pressure.

When the line is laid to the pumping engine, a tee is placed near the casing head, as shown, and a short 2-inch pipe is screwed into it to carry the gas away from the well head. An ell is installed on this line, and a swaged nipple reduces the size to fit the lower connection on the standing valve. Weight of the ball provides approximately four ounces per square inch pressure. This is sufficient to run the engine, yet will not affect the pressure on the sand face and prevent production from entering the well bore.



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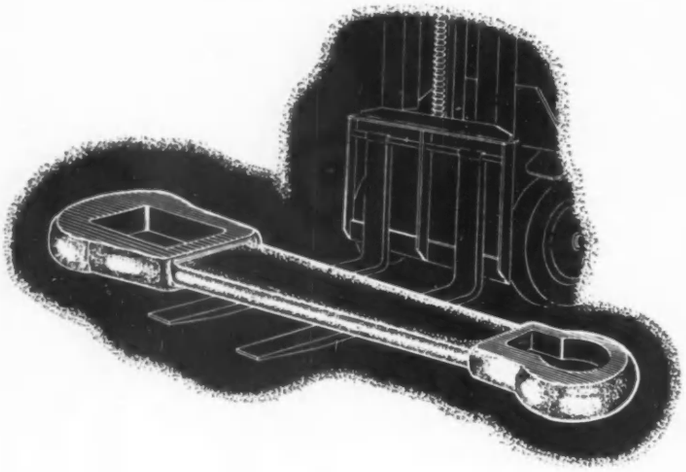

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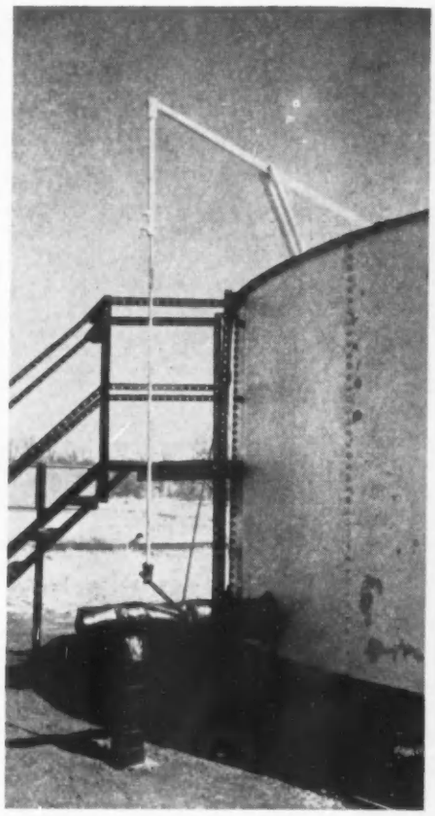
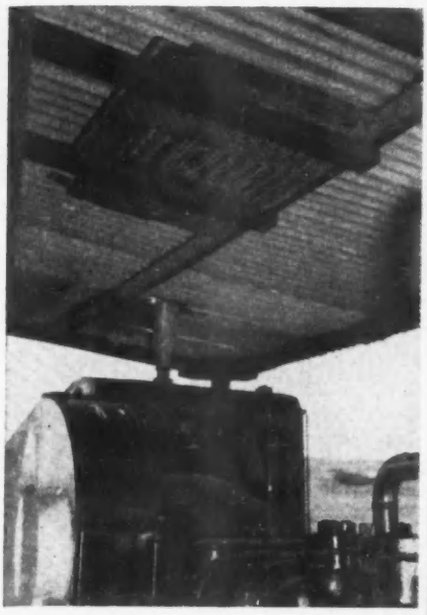


Install Butterfly Valve To Hold Water Level in Tank

To prevent air from going into the disposal well, it is necessary to hold a level in the gathering tank above the outlet. One company uses materials at hand to allow the water to leave as it is gathered in the tank from various tank batteries on the lease.

A butterfly valve is placed in the outlet line of the tank on the line to the disposal well and positioned so that it closes as the lever is lowered. A beam is fastened to a set of braces which are bolted to the top of the tank. A hollow, square rod is fastened to the outer end of the beam which allows a smaller rod to run inside. The inner rod is fastened to the lever. The other end of the beam is fastened to a float inside the tank. The telescoping part is adjusted to give a level about half-way up the tank. With this arrangement, air is prevented from entering the well, and a settling space is provided below the outlet for solids. A space above the outlet also is provided to trap any oil that may be carried over.



Overhead Rack Protects Engine Panels from Damage

To protect the removable side panels of a stationary engine from damage, one operator built a rack in the roof of the open lean-to type shelter covering the installation. Two 2 by 4's, laid flat, were spiked to the purlins immediately above the engine, leaving a four-inch storage space between them and the underside of the corrugated roofing.

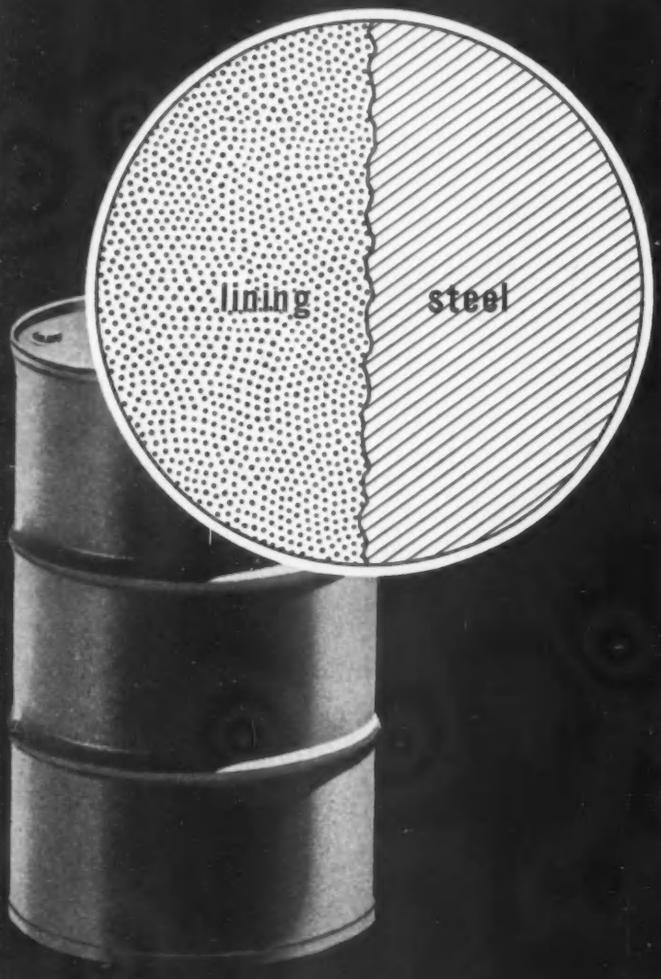
Whenever the panels are removed, they are slid into this rack where they are free from ground moisture and are in no danger of being damaged by careless handling. They are also readily available when needed.

Place Tool House Door Lock Out of Sight and Weather

A simple lock for the tool house door may be made by extending the latch to a bracket inside the door and placing the lock in matching holes. A sliding door over the lock keeps it out of the weather and makes tampering difficult.

The latch hooks onto the door frame on the inside and comes through the door to the handle for simple, easy operation. A hole is cut into the door a few inches from the handle and metal strips, welded to each side, form slides for the door. After the door is fitted, a bar with a hole drilled on one end, to match the

RHEEM DOES THIS . . .



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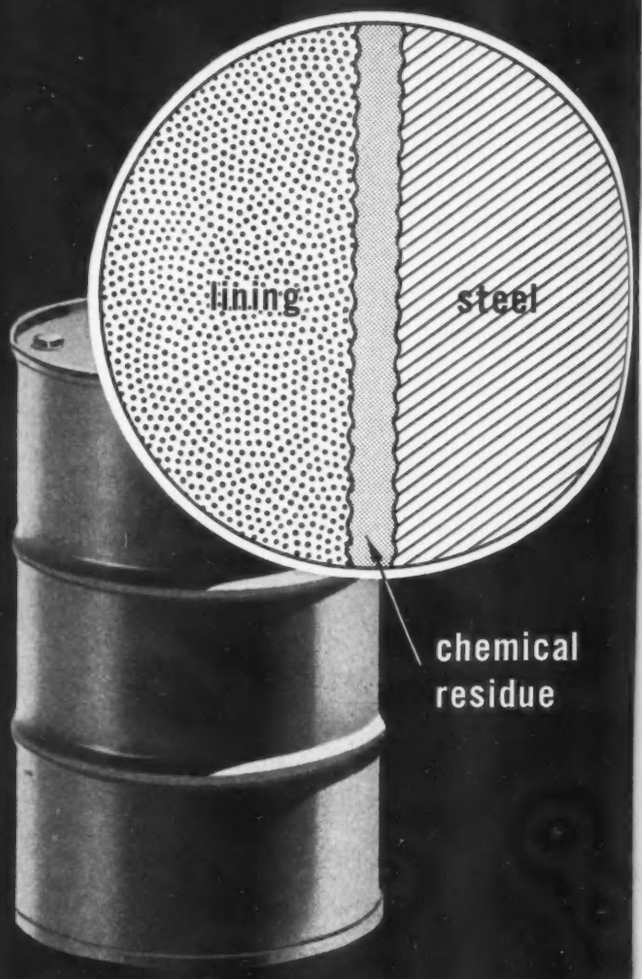

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1. INTEGRATED LININGS **2. SHOT-BLASTING**

Yes, Rheem linings are bonded *directly to the steel* with a bulldog grip. They're *integrated* linings. There's nothing between the steel and lining to cause flaking or peeling—*nothing that can be attacked by packaged chemicals!* And the linings last longer.

Rheem *physically* cleans and roughens its steel by shot-blasting. Bombarding the steel with high-carbon shot, Rheem can thoroughly remove scale *and* properly roughen the surface that must accept the lining. There is no chemical residue that could interfere with the lining application, and the hills and valleys of the steel offer a more positive gripping surface for the lining.

Next time you place an order for steel containers, remember this: Only *Rheem* drums have *integrated* linings. And because they last longer, they give you better protection for your product.

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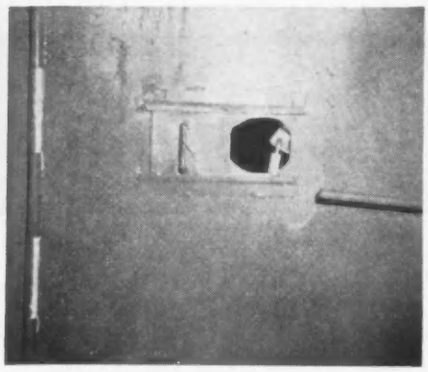
"It's better to ship in steel"



bar welded to the inside of the door, is then welded to the door latch so that when the door is latched it can be locked.

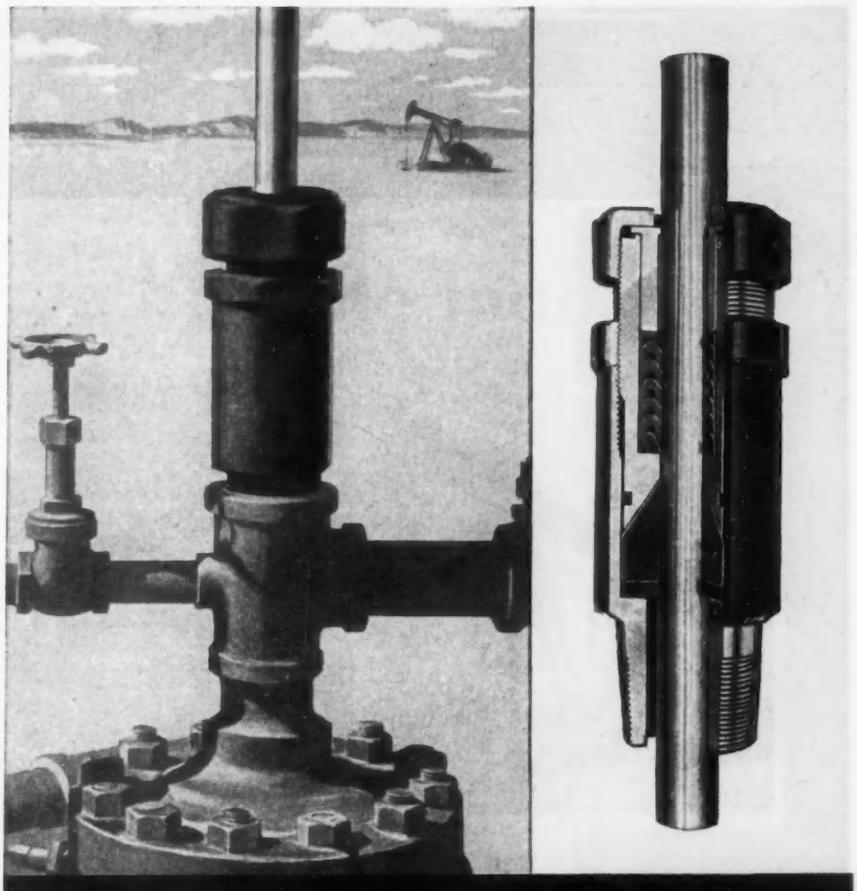
Make Production Test With 5-Gallon Bucket

When a pumper in the Lively field of McPherson County, Kansas, wants to know the rate at which a well is producing, he closes the flow line valve, puts a five-gallon bucket under the bleeder, and counts the seconds it takes to fill. A quick calculation gives him the rate in barrels per day.

The constant number is 10,286, but for practical purposes it can be rounded out to 10,000. By noting the number of seconds necessary to fill the bucket and dividing this number into 10,000, the pumper has the rate in barrels per day.

If it takes 200 seconds, the rate is 50 barrels per day; if it takes 50 seconds, the rate is 200 barrels per day.

$$\text{Bbls/24 hours} = \frac{(60)\ (60)\ (24)}{\frac{\text{seconds}}{5}\ \ (42)} = 10{,}286$$



D+B DUAL-PAC STUFFING BOX
boosts profits-with less servicing

Compact and efficient, the D+B Dual-Pac Stuffing Box saves you money in reduced maintenance time.

All metal parts are steel or bronze ... there are no castings to break or leak. The porous bronze gland, impregnated with oil, accurately centers the polished rod, eliminates contact with all other metal parts and reduces wear on the packing.

Dual packing permits replacement of the pressure seal packing without killing the well. By merely loosening the lock nut and screwing down the retainer with the cap, the lower packing is compressed forming a high pressure seal. Well flow is sealed off and upper packing removed without bleeding the head off the well.

Specify the best ... D+B products. Call CONTINENTAL or your D+B store for service anywhere ... any time.

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General Offices: Dallas, Texas
Representatives in all principal oil fields of the world

E-196-55

Adjustable Crank

Cabot

CABOT units have a universal base with easily interchangeable extensions to accommodate any prime mover.

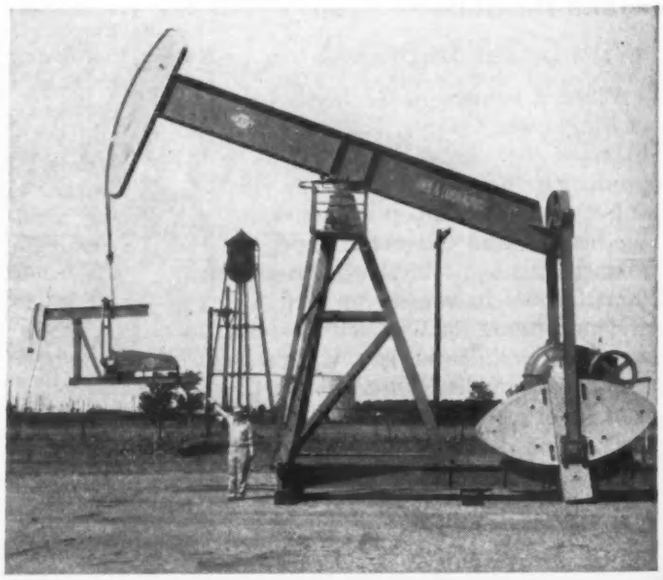
The one-piece reducer case houses the finest gears, shafts and bearings known to the industry. There are no oil seals. The reducer carries a five-year service guarantee that is valuable to the user.

The derrick-type sampson post is made of heavy angles with well-designed bracing members, boxed in at the top with steel plates.

It is never necessary to remove the walking beam to service a well equipped with a CABOT. Clearance has been increased by newly designed horseheads.

Floor-clearing bases, Vee belts, belt guards, reducer oil, and adjustable slide rails are standard equipment.

Here, for comparison, are CABOT'S largest and smallest units. The small unit is from the Beam Balanced Type B Series (limited crank counterweighting optional) rated from 3,000 to 11,000 pounds beam rating.



113 M

Pumping Units

built to serve best the man who owns the well!

Seventeen years ago CABOT engineered a line of pumping units to cut costs and minimize maintenance problems for producers.

CABOT units, built strictly to API standards, sell to the most exacting producers in the United States and Canada.

The Adjustable Crank Type AC series starts with a unit beam rating of 9,000 pounds, and a 40,000 in-lbs. reducer rating. The series includes a unit with a beam rating of 32,000 pounds and a 456,000 in-lbs. reducer rating.

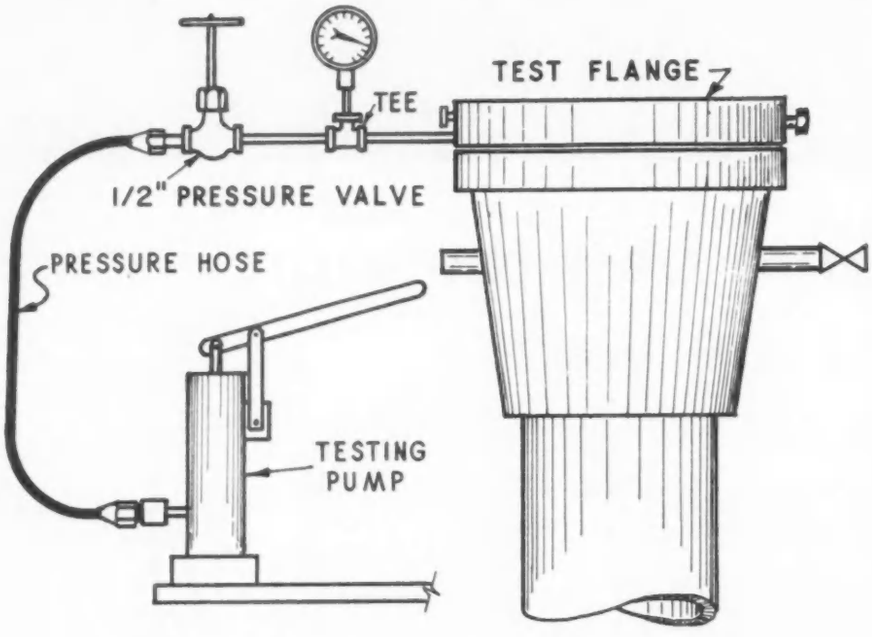
The Adjustable Crank CABOT* is floor clearing and equipped with a rubber tail bearing. This EQUALASTIC© bearing, patented and exclusive with CABOT, is a marked improvement in pumping-unit construction. It eliminates many parts and much maintenance. It does away with lubrication at this awkward point.

Any J&L man will welcome an opportunity to give you more interesting CABOT facts pertinent to production in your field, and detailed specifications.

*except AC-32

J&L STEEL

Jones & Laughlin STEEL CORPORATION
SUPPLY DIVISION — TULSA, OKLAHOMA
Serving The United States and Canada



Valve Blocks Test Pressure

As high pressure, hand-operated test pumps are not used frequently, slow leaks may develop in the assembly, and it is difficult to determine the true pump condition until the unit is placed in service.

To eliminate the possibility of pressure bleed-off through the pump assembly during packer tests, one operator has rigged an assembly of four ½-inch nipples, a tee, test gage and gate valve madeup as shown. With the ½-inch nipple on the gage side madeup into the test flange and a high pressure hose connecting the pump and pipe assembly, pressure can be built up and retained in the annulus by closing the ½-inch valve.

Salvaged Tank Steel Makes Low Cost Gravel Ring

In installations where it is necessary to raise a tank a foot or two higher than normal, good use can be made of the technique employed by one company. In place of the usual low steel gravel ring, salvaged tank steel is cut into strips, assembled, and either welded or bolted in place. Lengths of salvaged sucker rod material are driven into the ground at regular intervals outside the ring to hold it in position until the installation is completed.

To strengthen this higher-than-normal gravel-filled base, a length of sand line is passed around the periphery and drawn tightly with the aid of a turnbuckle.

(Pat. Pend.)

Air-powered
TUBING SPIDER
(A Cavins Co. Product)

Two more reasons for owning an
ADVANCE TUBING SPIDER

1 **CONSTRUCTION:** Heat treated steel is used throughout. With a minimum of weight and bulk you get the greatest strength and longest wearing life.

2 **LUBRICATION:** All bearings and journals equipped with grease fittings. Air cylinder and foot valve are mist lubricated thru the air stream.

Bulletin TS-54 tells the whole story.
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GEAR-WITHIN-A-GEAR
Rotary Pumping Principle

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MIDDLEMAN'S POWER

From a young engineer in Russia's Baku oil fields . . . *Mr. Five Percent* . . . talked himself into fame and fortune in oil

THE NEED for a ready source of substantial revenues to finance the royal extravagances of a Middle East sultan, including a harem that during the sultan's lifetime housed an estimated 30,000 women, led to the start of the greatest individual petroleum fortunes in the world.

A hard-pressed director of the privy purse in the domain of Sultan Abdul Hamid II of Mesopotamia once read the report by a young civil engineer of the Russian Baku oil fields and he began thinking how the discovery of oil in the sultan's realm would help him to finance the royal expenditures.

He asked the engineer, who had begun to create a name for himself in international oil circles shortly after the turn of the century, to make a study on the petroleum potential of the mosul region of Mesopotamia, which was then part of the Turkish Empire.

The report was completed but the engineer received nothing immediately but a "thank you" for his efforts, which he later admitted consisted only of reading travel books and talking with engineers who were surveying a railway site in the area.

As fortune would have it, the Mesopotamian (now Iraq) regime was overthrown in 1909 and the civil engineer wound up as chief financial advisor to the Turkish government. This sudden move was the work of a man who has never been known by many, who rarely has been photographed and whose vast operations in the international petroleum industry are still a partial mystery. The engineer was Calouste Sarkis Gulbenkian, often called the mysterious middleman of Middle East oil, or "Mr. Five Percent," who died July 20 in the seclusion of his Lisbon, Portugal, hotel apartment.

He was almost 86 years of age and death prevented him from gaining one of the few things he wanted, and failed to gain, in his lifetime. That was to live to be 106, because his father had reached 105, according to a story attributed to Gulbenkian. This was one of the few deals he couldn't arrange.

THE LATE C. S. GULBENKIAN
775 Million Barrels

Right Time and Place. Gulbenkian's fortune has been estimated at a billion dollars which, though based on petroleum, included diversified investments on several continents which were conducted through complicated holding company networks, agents, and typical of Gulbenkian—middlemen. Probably no one other than Gulbenkian actually knew fully about his wealth and the extent of his numerous financial maneuvers.

He was never an oil man by strict definition, but a middleman with a keen sense of knowing what was in demand and who could supply it. Men who have dealt with him describe Gulbenkian's operating procedures as "a man who could appear from nowhere with a proposition and who usually disappeared with a profit."

Gulbenkian's percentage of the oil wealth of the worlld amounted to 5 percent of the reserves controlled by Iraq Petroleum Company, Ltd. in the Middle East. Gulbenkian's share of the estimated proved reserves of Iraq Petroleum at the start of 1955 would amount to about 775 million barrels—a substantial percentage for any middleman. Such a volume of reserves is the equivalent of 0.8 percent of the conservatively estimated Middle East reserves and about 0.5 percent of the world's total known crude reserves.

Gulbenkian, who made a habit of being in the right place at the right time, got his start in life at the right place and the right time. He was an Armenian who was born in a suburb of Constantinople in 1869 and, conveniently enough his family were traders in the export-import business. The time of his birth was at the dawn of the oil age—six years after the discovery of oil in the Baku fields in Russia, and 10 years after Col. Drake's discovery in Pennsylvania. His family added petroleum to the list of commodities in which they traded and the youngster learned the business from the beginning.

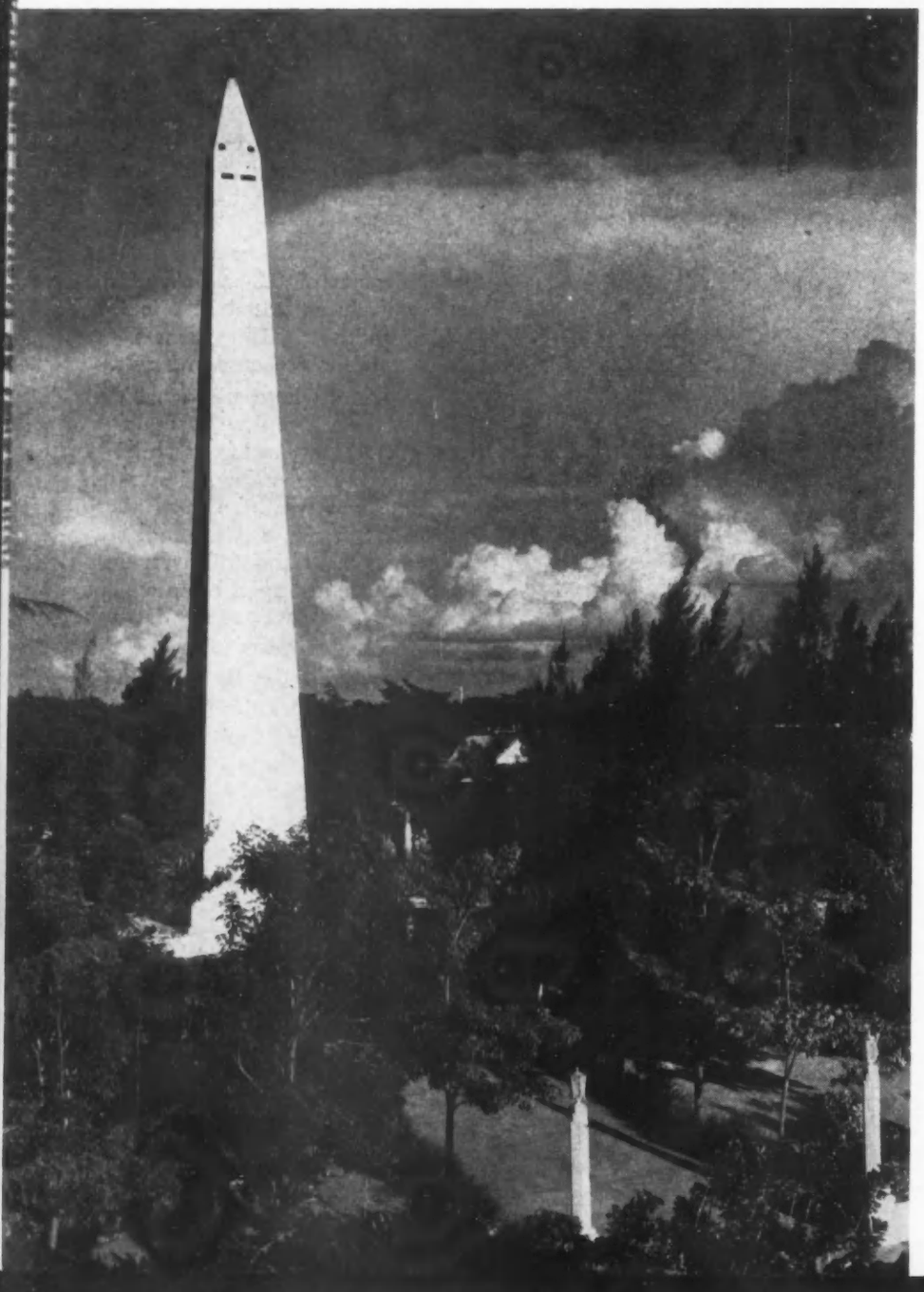
Gulbenkian and Shell. The young Gulbenkian graduated from Kings College, London, with a degree in civil engineering and, after a visit to Baku, wrote a scholarly and widely-read report on the Russian fields. His reward was the establishment of Gul-

Continued on Page 204

A CAMP CITY PROFILE

Maracaibo Goes Modern

Much of the old-world flavor is disappearing from Venezuela's booming No. 2 seaport. Replacing it is the more modern mode of living necessary to a thriving community which is home to many oil company employes.

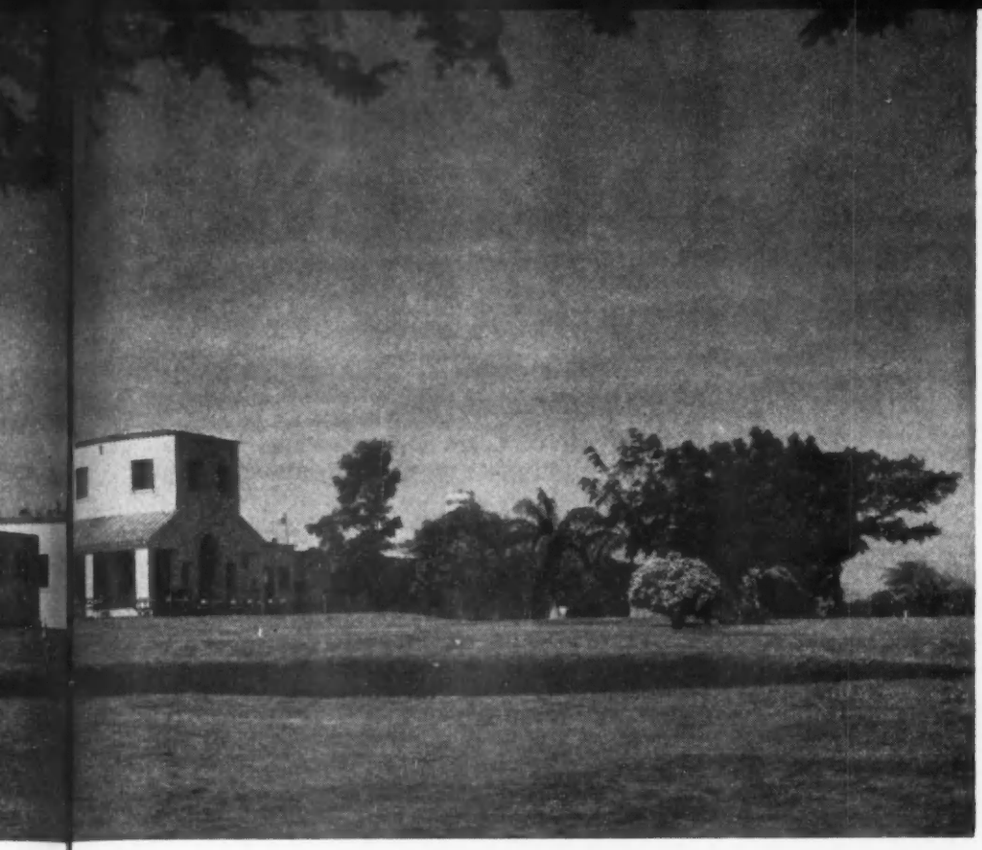


LARGEST CITY, population-wise, in western Venezuela, Maracaibo is the western division headquarters for many oil companies. Situated on the western shore at the mouth of Lake Maracaibo, what was 400 years ago a pirate's retreat from the rigorous and dangerous life of the Caribbean Sea, is today a cosmopolitan city replete with growing pains. Much of the old-world Spanish flavor is disappearing, replaced by the more efficient architecture necessary to a thriving community which has by no means reached its horizons.

Maracaibo is a sprawling city of 260,000 inhabitants built almost entirely at sea level. The original settlement lying along the lake shore has been supplemented by beautiful residential areas stretching to the northwest and north absorbing the three large oil camps into the city proper. New additions are growing up featuring California and Florida type construction which contrasts picturesquely with the Spanish architecture, palm trees and statue-dotted plazas.

Located eight degrees north of the equator, Maracaibo's tropical climate

La Plaza de la Republica is one of Maracaibo's prettiest parks. This aerial view shows obelisk and top of the band shell.



Maracaibo Country Club, just a few minutes' drive from the city, offers year-round activities for its members.

This feature, one of a series describing important oil camps or cities throughout the world, is intended only to describe living conditions and to give a bit of the local atmosphere. While an occasional one of the features may touch lightly on working conditions, it will do so only incidentally.

is refreshed about eight months of the year by the Caribbean trade winds. Having a wet and a dry season, the year-round temperature varies but a few degrees.

Days are hot and sunny with comparatively little rain even in season. Generally, the nights cool off enough to insure sleep. The entire city closes down at noon for a two-hour siesta, which foreigners soon find a "must" for them too. To counteract the heat, most businesses open between 7 and 8 o'clock each morning, remaining open until noon. Doors are again opened at 2 p.m., closed for the day at 6 p.m.

Oil company working schedules differ slightly, having a shorter working day. Many business houses are now airconditioned, as are most of the city's large office buildings. Many homes are also partially airconditioned—and electric fans of all kinds are necessary.

No. 2 seaport. Maracaibo is the country's No. 2 seaport. It may be reached by ship from New York and New Orleans, Europe, and other Venezuelan ports. Airlines enter its international airport directly from all the principal cities of the country, from Colombia, from New Orleans, and Miami, and indirectly from New York, France, and Brazil. Distance by car on good roads from Caracas, the nation's capital, is about 500 miles and requires two days with a stopover at night at Basquisimeto. Maracaibo is easily accessible from oil camps and fields across the lake by ferryboats running on almost an around-the-clock schedule.

Municipal transportation is good. A network of buses reaches all points. Public cars, known as "reál cars" travel pre-determined routes and run from suburbs to the center of town. Taxicabs are plentiful. Generally, oil companies do not supply transportation to employes. Although it is not necessary to have a car with which to get around camp, most families have cars for shopping and social use.

The area is not naturally verdant, and the surrounding countryside is generally parched. But the city is made attractive with planned planting kept alive with almost constant watering.

Heart of the business section for many years has been in downtown Maracaibo. It is there that local and national government buildings are located. As city limits have expanded, shopping sections have developed in residential areas where many stores, banks, airlines etc., have branches.

Household food supplies can be bought in the local market downtown, at free markets throughout the city, or in one of the ultramodern supermarkets. The old market is hot, crowded, picturesque, and fly-infested. Meats, fish, fresh fruits, and vegetables—local and imported—are available there in quantity and at the best prices anywhere in the city. Open early in the morning, best buys can be made before 10 a.m., after which heat begins to spoil the produce.

Also available in market stalls or from cruising salesmen are notions, pots and pans, livestock, pets, household staples, plants and shrubs, and shoes. In stalls outside the market building, displayed in simple wooden stands or on the ground, is available practically anything that may be desired. Prices are not fixed so constant bargaining is part of the shopping routine.

Pineapple, papaya, bananas, limes, avocados, watermelon, and many other local fruits, are plentiful most of the year and are relatively inexpensive. Fresh vegetables, chickens, eggs, rice, flour, black beans, and sugar are available in unlimited quantities. Imported canned goods, fresh fruits and vegetables and frozen packaged foods are also plentiful, but more expensive.

Clubhouse and pool on Shell Caribbean camp grounds in the beautiful Bella Vista section of the city is a center of interest.

Livestock abounds in certain sections of the country, and the beef is very good; however, choice cuts of meat are not always available. Besides beef, pork, lamb and veal, locally-raised turkeys and ducks, both "on the hoof" and frozen are available.

Prices higher. Department stores and specialty shops sell everything and anything. Sears Roebuck's modern store was a welcome addition two years ago. Prices everywhere are generally three times greater than stateside prices.

The average foreign family in Maracaibo employs from two to five servants: a maid, a cook (harder to get), a laundress, a gardener, and sometimes a nursemaid. The climate makes it impractical to do one's own work. Servants are available, but it is difficult to find trained help. In postwar years, wages have doubled. "Kitchen Spanish" is necessary for the lady of the house in order to manage a household properly and can be learned in short order. Fluent Spanish is advisable, but not necessary—for many Venezuelans speak English, ranging from only a few words to non-accented.

In the past two years dry cleaning plants have been modernized, and non-washable clothing is used more than formerly. Because of the heat, lightweight, washable clothing is best. Casual dress is generally the style, the women doing their household chores in shorts and sundresses. Slacks or shorts should not be worn on the street or in the shops. Frequent washings and the unrelenting sun are hard on cottons, so ample wardrobes are necessary.

Clothing for men, women and children can be bought in Maracaibo, but much of it is nationally made and all of it is expensive. Shoes are difficult to buy. Domestic footgear is constructed on short, wide lasts to fit the smaller Venezuelan foot.

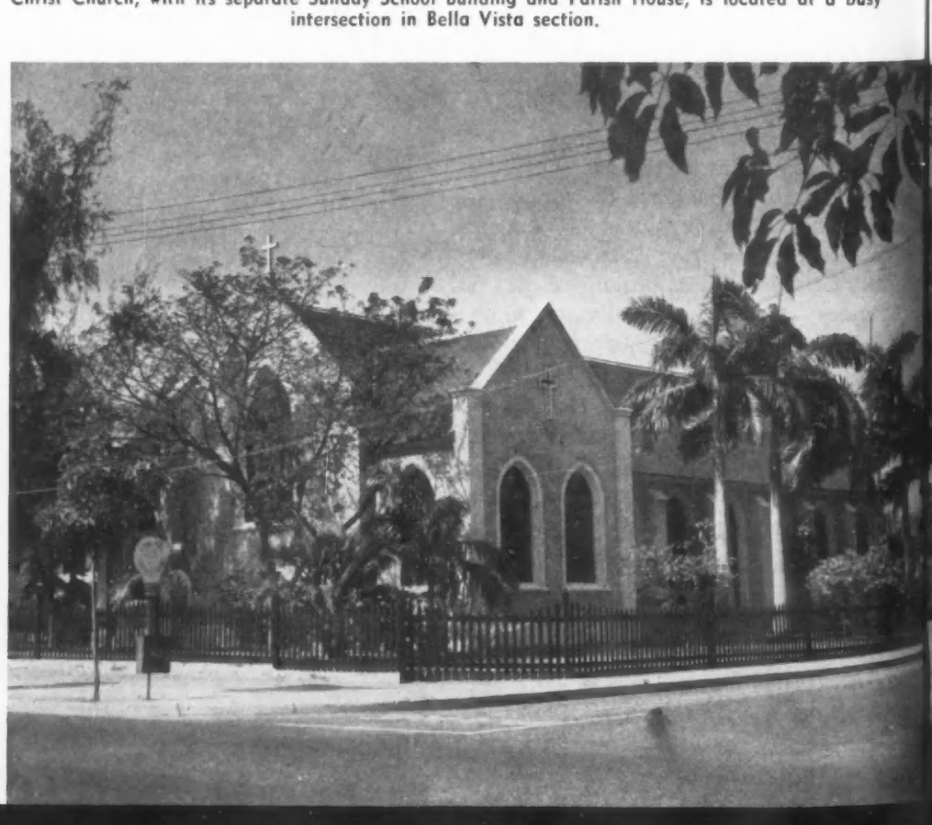
Men usually wear white shirts with sleeves buttoned down and ties with linen, cord or tropical suits. Suit coats are necessary only in government buildings, church or during business calls. In offices, jackets are removed. Sports shirts are worn at home and around the camps during leisure moments.

Formal clothes are donned several times a year—at club parties. Hats and nylons are seldom worn, gloves never. Dressy cottons with high-heeled shoes are appropriate for afternoon gatherings and evenings. Several formal dresses and a few cocktail dresses are necessary. Taffetas, nylons and satins are worn in the evening from December through March and are comfortable. Most men find at least one dark suit necessary.

Three large camps. In Maracaibo itself are located three large oil company camps with a fourth situated a few miles south of the city, high on a hill. These camps were originally constructed to provide foreign staff with housing and conveniences. Besides houses, they contain office buildings, clubs, bunk houses, recreational facilities, pools, maintenance shops, mess halls and commissaries. Camps are attractively laid out, having good streets but generally no sidewalks.

Houses are similar on the outside, often painted pastel colors, screened and placed close together in blocks. Until recently, basic furniture was

Christ Church, with its separate Sunday School building and Parish House, is located at a busy intersection in Bella Vista section.



supplied by the individual companies, and other household effects such as lamps, end tables, linens and kitchen utensils were brought from home. In many instances, this policy has been changed, and camp residents have had to purchase what was already in their houses or refurnish them on their own. Newcomers are often assigned empty houses.

Attractive Venezuelan wood and rattan furniture can be bought readily and in a variety of designs. Materials for slip covers and draperies are plentiful.

Maracaibo offers ample athletic recreation. Besides oil company pools, tennis courts, soccer fields, bowling alleys, and baseball diamonds there are facilities in private clubs to which oil company foreign staff usually have admittance, an 18-hole golf course, a new yacht club and public beaches near to the city. Company and intercompany sports are arranged on a yearly basis and claim heavy participation. Unusually fine fishing is to be had in Lake Maracaibo, and boats are available for hire.

Individual companies plan activities for their young people as well as adults. Swimming events are held, Christmas and Easter parties for the youngsters and teenage parties given when the older children are in camp for the summer holidays.

Company club activities include bridge and bingo nights, horse racing, juke box parties, well-stocked libraries, barbecues, and orchestra dances under the stars several times a year. Outdoor movies are held several times a week.

Modern architecture now used in Venezuela is exemplified by Radiolandia building, which houses one of Maracaibo's radio stations, a night club and offices.

Private informal dinner parties are frequent, and bridge and canasta luncheons and teas for the women are regular events. Charity organizations, such as Red Cross, welcome willing workers.

The arts. "The Maracaibo Players," a little theatre group and "Bellas Artes," a cultural center, have memberships open to all. The city has numerous theaters which usually book American or English pictures having Spanish subtitles, although French, Italian, and Mexican movies can be seen occasionally. Dancing classes of all kinds are available, and a Civic Music Association imports noted artists in a concert series. A symphony orchestra and a mixed chorus always welcome participants.

Several good restaurants are located in the city, and two or three night clubs with small orchestras for dancing. Prices are generally high, service good and food average. The beautiful new Hotel del Lago has become the center of much of the city's social activities, though several other hotels offer attractive bars and dining rooms for public use.

Two schools where instructions is in English operate in Maracaibo, subsidized by the oil companies. Both are open to all students from kindergarten through the ninth grade. Instructors are from England and the U. S., and the curriculum enables passing students to go on to high schools in their native lands. Venezuelan nursery and private schools have an open registration and are good; instruction is in Spanish.

Oil companies have provided for older children attending high schools outside Venezuela to visit their families during the summer holidays.

Christ Church takes an active part in community affairs. This Anglican

An oil company camp located in Maracaibo. This view shows houses and recreational area, main office building lower left and mess hall and shops lower right. Top center is Coromoto hospital.

A modern tuberculosis hospital is located high on a hill south of the city of Maracaibo. It's an indication of the country's awareness of the health of its people.

church welcomes Protestants of all nationalities to its two Sunday adult services and children's Sunday school. The church is staffed by a British minister who also holds monthly services in the oil field camps.

Numerous Catholic churches are in Maracaibo. "San José" draws most of the English-speaking Catholics. Although the sermons are in Spanish, most priests speak English. In conjunction with several English-speaking Catholic mothers, religious training is available for foreign children.

Other sects have missionaries in Maracaibo and weekly meetings are open to the public. People of the Jewish faith conduct regular services.

Medical services. Foreigners may place their health and lives in the hands of many well-trained doctors. Oil companies maintain their own medical staffs. Most of the doctors speak some English, and many have taken special training abroad.

Shell Caribbean Hospital is maintained by one company for its employes, housing a clinic and clean, modern rooms and equipment. Staffed with Venezuelan doctors and nurses, a British matron and several European nurses, it affords excellent care.

Coromoto Hospital recently was built by another oil company and has been leased to a nursing order of nuns from the states. Its clinic and air-conditioned rooms are equipped with modern facilities. It, too, is staffed by Venezuelan doctors and nurses, as well as by nuns.

Medical care in both hospitals is of the best. Employes and their families benefit from companies' medical programs. In the city are other hospitals and clinics which take private patients at high rates. Many doctors are English-speaking, and there is a specialist available in every field. Dental facilities are good, but dental care is not offered in oil company medical programs.

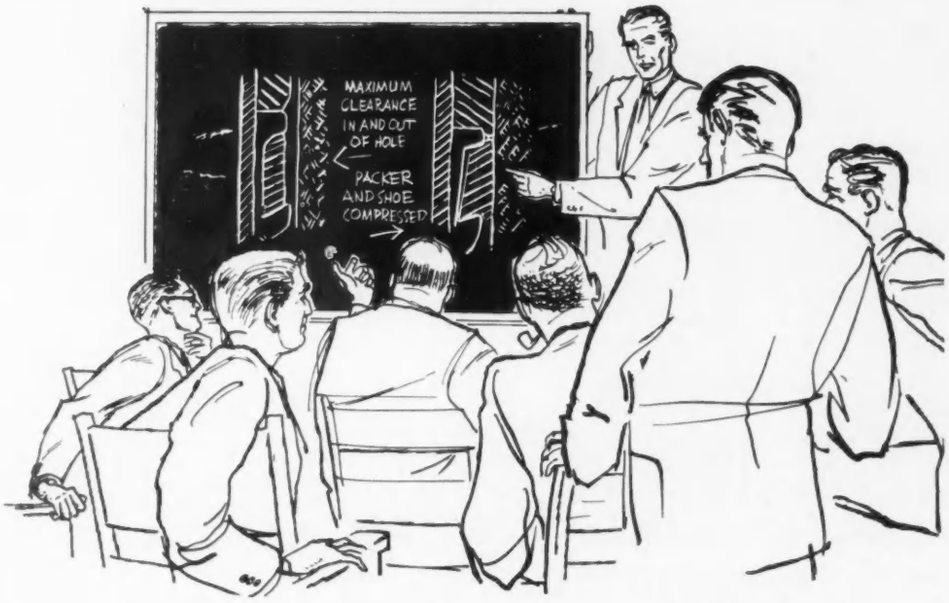
Points of interest abound in and around the city. Nearby is Zuruma, a village peopled by the Guajira Indians, a colorful and paceful tribe subsidized by the Venezuelan government. Within a day's drive are several clean and attractive mountain hotels, featuring good food, cold nights, beautiful gardens with occasional snow-topped peaks nearby. The Isle of Margarita, famous for its pearl fisheries, can be reached by ship or air. Pleasant hotels and beaches make it a tourist attraction.

People friendly. As a community, Maracaibo has much to offer. The people are extremely friendly—the Venezuelans are kind and always patient with a beginner's attempts in their language. They are anxious to understand and to be understood.

Because oil companies have western division headquarters in Maracaibo, many foreigners are concentrated in the city. Businesses related to the oil industry have representatives in the city, as well as airlines, shipping companies, banks, consulates, and other commercial enterprizes. Consequently there is a good sized group of foreigners in Maracaibo who contribute generously in the interchange of habits, social customs, national foods and drinks, ideas and opinions.

Employes and their families are not restricted to camps, but can go to the city when a change is desired. And Maracaibo offers as much as any good sized city anywhere in the world.

—**The End**



PACKER EXTRUSION REDUCED BY UNIQUE EXPANDING SHOE

one of many reasons why

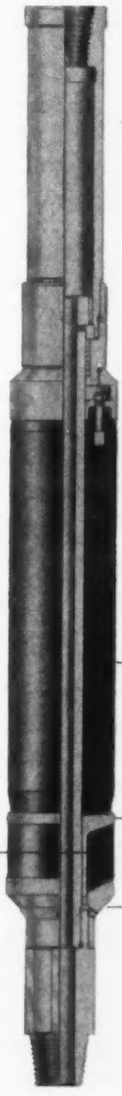
HALLIBURTON'S best for your drill stem test!

A most important factor in the success of deep well testing is packer performance. Packer must be specially designed and ruggedly built to seal off in the hole and resist the high pressures and mechanical loads that occur in these deep wells.

Halliburton's unique Expanding Shoe Packer meets the requirements with excellent results. The Shoe is a hard rubber, sleeve type device used below a softer rubber single end packer, and it has steel supports to carry most of the packer load. The assembly retracts to packer diameter and maintains maximum clearance going in and coming out of hole.

When packer is set the shoe expands to the wall and reduces the area available for extrusion. This reduction or elimination of extrusion minimizes the danger of stuck packers, damage to formation, rubber left in hole, excessive jarring and pulling, mis-runs in over sized holes, and saves much time in making test.

Efficient packer performance is one of the many reasons why Halliburton's best for your drill stem test. Your testing operator will show you all the advantages of Halliburton's Testing Service that can make your job easier, better, more successful. Phone your local or district office of the Halliburton Oil Well Cementing Company.



HIGH QUALITY RUBBER PACKER

For sealing against formation

STEEL SUPPORT

Carries most of packer load

HARD RUBBER EXPANDING SHOE

Provides support for that part of the packer rubber which tends to extrude over the steel support

STEEL SHOE

Supports expanding shoe rubber. Protects rubber while running in hole

HALLIBURTON
TESTING SERVICE

250 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

What's Happening

AMONG WORLD OIL MEN

C. U. Daniels

Ray Althouse

C. U. DANIELS of Calgary, president and managing director of Royalite Oil Company, Ltd., since August, 1951, has been appointed chairman of the board, and RAY ALTHOUSE, also of Calgary and executive vice president since 1952, has succeeded him to the presidency.

•

SIR WILLIAM FRASER, chairman of The British Petroleum Company, Ltd., has been named a baron in Britain's New Year Honor's List. Fraser began his career with Pumpherston Oil Company, a shale company founded by his father.

•

H. B. Britton

H. B. BRITTON, vice president of Trans-Arabian Pipe Line Company, has been elected executive vice president. Britton, who joined Tapline in 1951, will make his headquarters in Beirut, Lebanon.

•

JOHN E. HUFF, JR., of Houston, Texas, has been named general manager of Talon Petroleum, C. A., and has moved to Venezuela to direct development and production activities for the oil firm. He has been an independent oil operator since 1947 before joining the South American company.

Talon operates a 7500-acre concession in western Venezuela, just east of Lake Maracaibo, acquired in 1952 from the old British Controlled Oilfields, Ltd., by Cecil V. Hagen, Houston geologist and oil operator, and a group of investors.

M. M. BECKES, manager of the newly-created operating department of Socony Mobil Oil Company, Inc., has announced eight personnel appointments. They are: C. W. PEASE, wholesale plant manager; L. E. REED, motor vehicles manager; E. M. PRUDAMES, retail plant and equipment manager; H. W. GERLACK, administrative assistant; L. F. DEDITIUS and A. W. DUDLEY, operating analysts; J. T. CARPENTER, petroleum losses analyst; and R. J. WHITLEY, motor vehicle engineer.

•

WILLIAM EWING EADIE has been named managing director of Burmah Oil Company in London. An accountant, Eadie has served the Company 34 years in Burma, Calcutta and London. He joined the board of directors in 1950, and in his new post replaces W. E. V. ABRAHAM, who is retiring at his own request from the managing directorship. Abraham will retain his directorship.

W. E. Eadie

•

TOM STEELE, public relations officer for the Canadian Petroleum Association since 1953, has succeeded LARRY F. FRANTZ as co-editor of the *Daily Oil Bulletin*, Calgary, Canada. Steele has been active in newspaper and radio work in Calgary and Edmonton. In 1949, he was appointed assistant director of publicity for the Alberta government. In 1951 he became public relations director for the Alberta Hotel Association, and resigned that position in 1953 to join the CPA.

He will be succeeded in the CPA post by JOHN S. PEACH, who for three and a half years has been western representative of the National Council, Baking Industry.

Frantz resigned from *Dail Oil Bulletin* to head Foothill Printers Ltd., Calgary, and to become president of Western Naco Petroleums Ltd.

CLARENCE G. MATTHEWS, veteran Canadian oil figure, has been appointed drilling engineer of General Petroleums of Canada, Ltd. He began his career in the industry in 1932 when he was employed by Hiway Refineries and served as refinery superintendent at the company's various plants. In 1937 he joined the Anglo Canadian Oil Company as assistant superintendent of the Brandon, Manitoba, refinery. In 1938 he transferred to Turner Valley and became production superintendent for Anglo Canadian when the late H. E. Denton left the company to form a consulting firm with Cody R. Spencer. In 1944 he joined the Denton-Spencer Company, Ltd., as a partner and field superintendent, and in 1951 he became associated with New Superior Oils of Canada, Ltd., as drilling and production superintendent, the position he held when his appointment by General Petroleums was announced by the president, Cody R. Spencer.

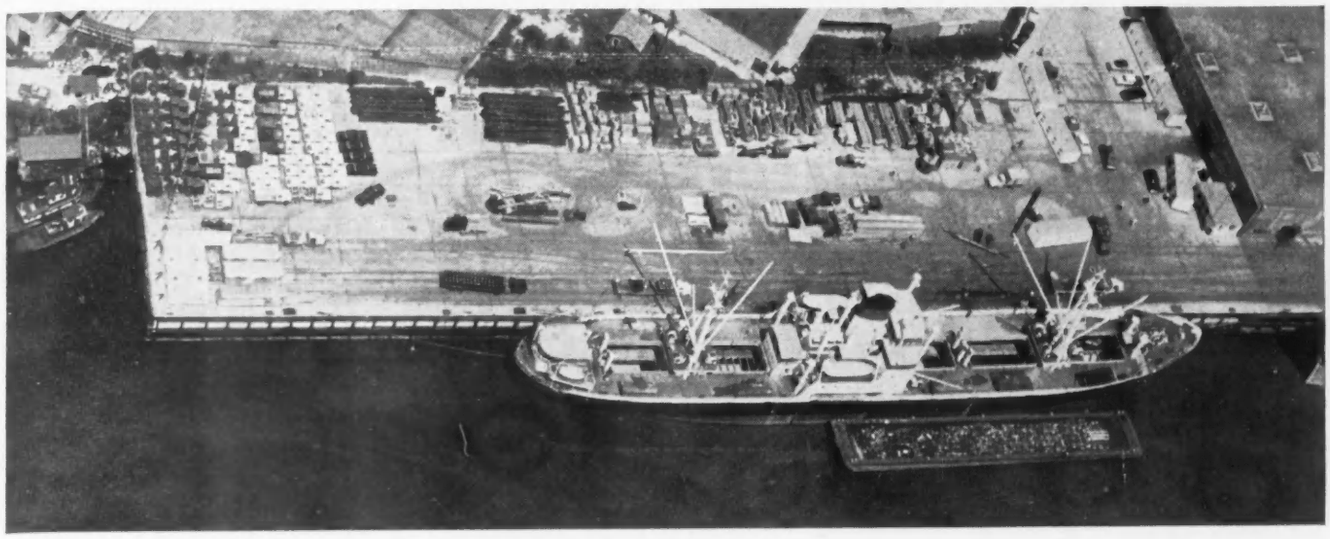
C. G. Matthews

Other recent executive personnel changes in the company, announced by President Cody, include:

The resignation of HARRY E. HOWARD, F.C.A., as secretary of General Petroleums, New Superior Oils, Edmonton Pipe Line Company, and Altex Oils, Ltd. A member of the original group of incorporators of these companies, Howard will remain a director.

The appointment of L. C. BOWES as secretary, replacing Howard. Bowes has served as assistant secretary, chief accountant and office manager during the 11 years he has been with the companies.

The appointment of GEORGE CLARKE, C.A., as comptroller of General Petroleums. Clarke became a chartered accountant in 1932, and has been with the Calgary firm of Clarke & Gordon-Cooper since 1951.



The Ms Belmonte loading cargo at Houston dock consisting of $2,550,000 in equipment for construction of a 450-mile pipe line across Turkey.

Americans Sail to Build Turkish Pipe Line

Complete equipment to build a 450-mile pipe line for the Turkish government sailed recently from the port of Houston, Texas. Along with the machinery and materials was a small village of air-conditioned, skid-mounted houses that will shelter the American crews as they lay the 4, 6, and 8-inch line from Iskenderun, on the eastern tip of the Mediterranean Sea, to Batman, 450 miles to the northeast.

Owner of the $2½ million equipment array is Associated Pipe Line Contractors, Inc., Houston, who has contracted with the Turkish Ministry of Public Works, to build the NATO Program oil carrier.

As the German freighter, M. S. Belmonte, cleared with this giant overseas shipment, her hold and decks carried 65 automotive units, 17 houses and trailers, 21 tractors, an airplane, ditching machines, and millions of pounds of other equipment and supplies.

Offshore Exploration In Egypt Is Being Pushed

International Egyptian Oil Company, Inc., currently has two exploration crews operating on the Siani Peninsula in Egypt. Geophysical Surveys, Inc.'s sonic marine geophysical boat has just completed an extensive survey of the waters embraced in International Egyptian's lots offshore from the Wadi Feiran and Belayim oil fields.

Company officials have expressed considerable optimism as a result of this work, coupled with the results of land seismic activity and results of the first four wells drilled in the Feiran field and the first five wells in the Belayim field.

It is reported that Belayim oil field could be many times larger than the Ras Gharib field, owned by Shell across the Gulf of Suez, if geophysical data and drilling indications to date are indicative. Ras Gharib field has yielded 150 million barrels of oil and currently is producing at approximately 25,000 barrels daily from eight horizons.

A new deep water marine terminal is scheduled to be constructed by International Egyptian a short distance south of the Belayim field. When the proposed marine terminal is completed, at least 25,000 barrels of oil can be handled daily.

3 New Oil Deposits In Mexico Are Discovered

Recent exploratory activity in the state of Puebla by Pemex geologists has resulted in the discovery of three new oil deposits, according to Petroleos Mexicanos, government owned oil monopoly.

The new areas, where drilling will be started in the near future, are in the municipalities of Ayoxtoc, near Tehuacán, Río Frío, and Tecamachalco.

Italian Oil Explorations By ENI, Others Increasing

Ente Nazionale Idrocarburi is conducting oil exploration operations in Italy's Abruzzo region, in the Sinello Valley in the Vasto region, and in the Pietranico district at the bottom of the Majella mountain.

In the Scerni district, near Vasto, ENI has started drilling a wildcat which was drilling ahead at 6240 feet to a projected depth of about 9850 feet.

In the Casoli zone, an exploratory well drilled to 4921 feet reportedly showed such favorable indications of oil that ENI plans to drill six more wells in the zone this year.

Other exploration activity is in progress in the Northern Sele Valley in the province of Salerno. The Societa Idrocarburi Castelgrande, headquartered at Milan, has applied for exploration permits in the following districts: Serre, Postiglione, Controne, Castelcivita, Albanella, Capaccio, Corleto, Roccadisoide, Castel San Lorenzo, Ottati, S. Angelo, Monforte, Bellosguardo, and Magliano Vetere.

John Biard, an individual, of Rome, has applied for exploration permits in zones of Contursi, Roscigno, Sacco, Piaggine, and Petina.

J. Hudson, an individual, also of Rome, has applied for permits in the districts of San Pietro al Panagro, Sanza and Monte San Giacono, in Salerno province, and Fratte, Brienza

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However, since it currently appears that the Parliament may not approve a new mining law, development concessions will not be granted. Cigno 1, the new discovery at Alanno, still is closed in, for only the Italian state monopoly is authorized to develop and produce oil. Cigno 1 was discovered by the Petrosud Company.

Gulf Subsidiary's 7th Ragusa Well Producing

Gulf Italia Company, Gulf Oil Corporation's subsidiary, reportedly has production from its seventh well in Sicily's Ragusa oil field, which adjoins the eastern boundary of the Comiso permit held by the Mediterranean Oil Company. Mediterranean Oil is owned 65 percent by Gulf and 35 percent by Macmillan Petroleum. Reports indicate the well may increase Ragusa field's production to about 5300 barrels a day.

On July 16, Gulf Oil began drilling a well near the town of Chiaramonte Gulfi on a location about one and one-fourth miles from the northeastern boundary of the Comiso permit. Results of this well, which is being drilled prior to drilling on Comiso, will help in evaluating the potential of this prospect.

Russia Studying Concrete Crude Storage Tanks

Russia's chronic metal shortage has caused Soviet oil industry officials to investigate the practicability of using concrete storage tanks.

Pravda reports that the Eastern Oil Industry Construction Trust has completed a six-months test with an experimental tank of large-pored concrete. Quality of the oil placed in the concrete tank was unchanged, and losses were 2.5 times below the norms established for metal tanks, the paper declared.

Seismic Tests Conducted For Spanish Government

The Precision Exploration Company is conducting seismic tests in Spain as a part of the Spanish government's campaign to develop commercial production.

The Tulsa company has a seismic contract with the Baldebro oil inves-

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tigation commission, the Spanish government agency, and a group of U. S. companies headed by General American Oil Company of Dallas, Texas.

Precision Exploration has two crews in Spain, according to E. G. Schempf, president. One unit is working in the Burgos area in the Ebro river basin of northern Spain. The other operates out of Cuenca, 90 miles southeast of Madrid, where traces of oil have been encountered.

The firm of DeGolyer and MacNaughton, consultants of Dallas, is carrying out the geological program for the Spanish government agency and its operating partners.

The current exploration campaign in Spain was stimulated last year when Esso Standard, SAF, subsidiary of Standard Oil Company (New Jersey), discovered a major oil field in southwestern France between Bordeaux and Bayonne.

The Bordeaux field is "just around the corner" of the Pyrenees from the northern border of Spain, Schempf said. Similarity of geological formations on the French and Spanish sides of the Pyrenees gives the Spanish government hopes of finding a field on its side of the mountains.

Most exploratory activity has been concentrated in the Ebro river basin just south of the Pyrenees. Miocene and Cretaceous outcrops are evident in the Burgos area of this basin.

Valdebro furnishes half of the capital for the program to find production, with the General American group providing the remainder.

Discovery Is Reported In Northeast Hungary

Limited success is reported from the northeast territory of Hungary, where exploration operations located a small deposit of oil. During 1954, natural gas was discovered in Oerszentmiklos, near Budapest.

The prewar Manart enterprise, which engaged in exploration, in 1945 was replaced by the jointly-owned Rumania-Soviet-Hungarian Meszovol. The latter enterprise was sold to the Hungarians during the fall of 1952.

Russia Claims Oil Discovered on Kama River

Russia claims to have achieved "remarkable success" in its search for oil on the north bank of the Kama river.

The newspaper Pravda reports that "a powerful oil gusher has erupted from a 5325-foot test well near the river bank." It said a second test well was near the 5000-foot level and several more will be drilled in the near future.

Russia began large-scale oil prospecting along the north bank of the Kama in 1952.

New Fault Block Yields Natural Gas at Bentheim

Norddeutschland 5, extension well of the joint interest C. Deilmann-Gewerkschaft Elwerath, about 1.2 miles northwest of Norddeutschland 2 of the Bentheim natural gas field has struck gas in the platten-dolomite of the Zechstein between 5150 and 5200 feet.

Significance of this new well is that it discovered a new fault block of the Bentheim gas structure. Production tests were still in progress so that details on the well's production were not immediately available.

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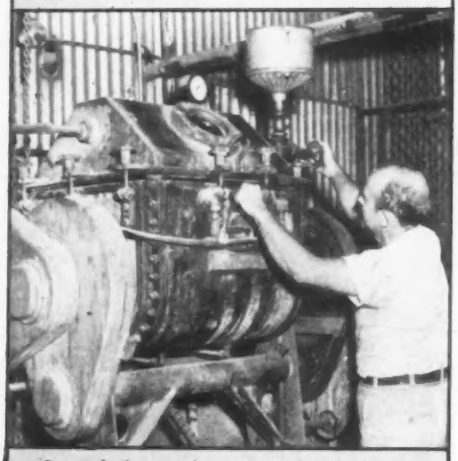

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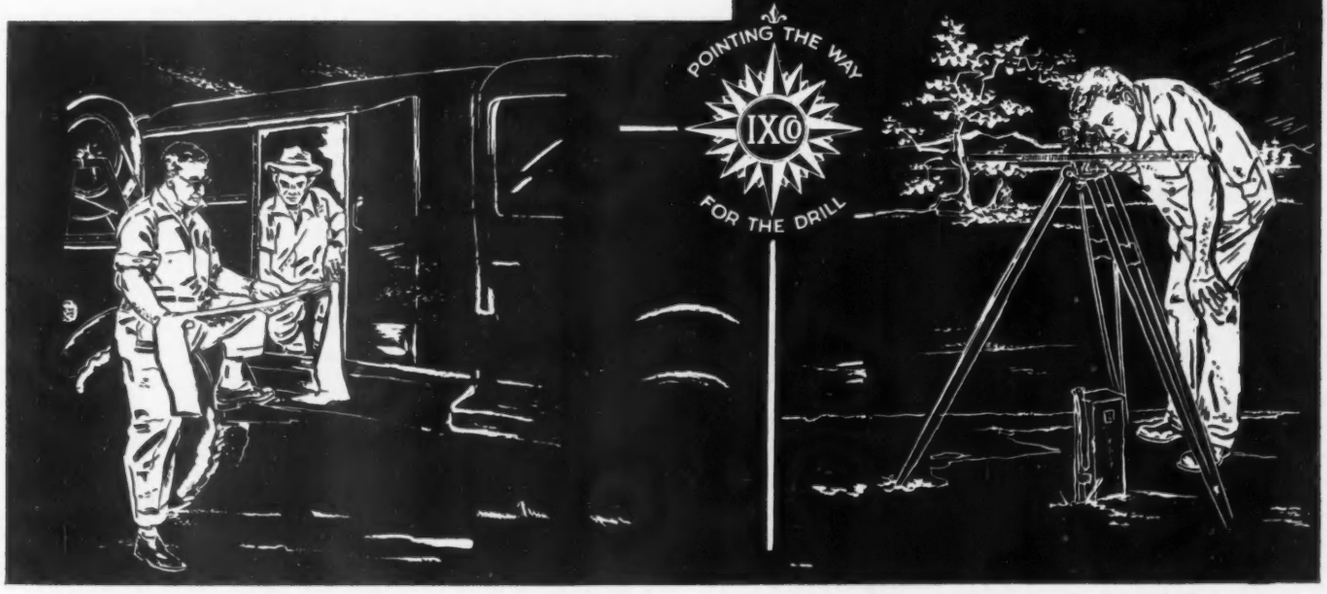

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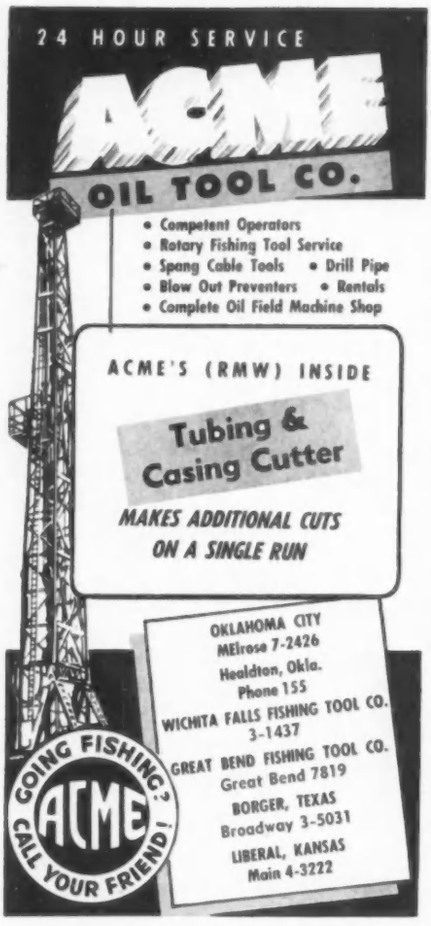

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Middleman's Power

Continued from Page 191

benkian in London as an agent for various Russian oil producers. He associated with some of the top men in the oil industry and was able to become a middleman between Sir Frederic Lane of the Rothschild petroleum interests and Henri Deterding of Royal Dutch.

Gulbenkian played a role in the union of Royal Dutch and Shell Transport and Trading in 1907 and became a big stockholder in the newly-created giant oil company. After years of close association with the Royal Dutch/Shell Group, he disagreed with the company in 1926 over a discussion involving Shell's operations in Venezuela. In 1931 he dumped large blocks of the company stock simultaneously on various European stock exchanges. Though the stock was eventually stabilized, Gulbenkian reportedly made a sizable profit by actually selling "short" and rebuying after he had forced a near collapse in the price of the stock.

His appointment as financial chief by the Turkish government paved the way to the start of his real fortune. By the time of this event, Gulbenkian had become a British citizen and his part in the Royal Dutch/Shell union made him an important man. He supported the British desire to get the upper hand of influence in Turkey at the expense of Germany and he was sent on a British technical mission to Turkey and became a director of the British created National Bank of Turkey.

Through developments still not quite clear, Gulbenkian established the Turkish Petroleum Company in 1911 to search for oil in Mesopotamia. Ownership of the company prior to World War I was held 25 percent by German interest, 35 percent by British interest and Gulbenkian held a 40 percent share. This was before his break with Shell so Gulbenkian cut Royal Dutch in for 25 percent and retained 15 percent for himself. The British Foreign Office tried to freeze Gulbenkian out by moving the D'Arcy interests (later Anglo-Iranian Oil and now The British Petroleum Company) into the venture. The war came, though, and Gulbenkian was instrumental in getting the German interest in Turkish Petroleum Company transferred to a French government-controlled group and thereby gained support for his share in the company.

Gulbenkian and IPC. In the middle 1920's when five American companies succeeded in getting a share of oil concession in Mesopotamia through treaties, Gulbenkian was able to get a firm 5 percent interest in the redivided Iraq Petroleum Company which now has substantial reserves in Iraq, Qatar and on the Trucial Coast.

Not content to sit back in his latter years and collect the flow of Middle East oil royalties, Gulbenkian singlehandedly almost prevented the formation of the present Arabian American Oil Company in 1948, a major crude producing company in the world.

The American entry into Iraq Petroleum Company in 1927 was through Near East Development Company, which holds a 23.75 percent interest in the producing company. The original five U. S. companies in Near East Development later narrowed down to two—Standard Oil Company (New Jersey) and Socony-Vacuum Oil Company.

The owners of Iraq Petroleum (which in addition to Jersey and Socony are British Petroleum Company, Compagnie Francaise des Petroles, Royal Dutch Shell and Gulbenkian) in 1928 made an agreement to operate jointly in the Middle East. A red inked line was drawn around the old Turkish Empire, which included the present Turkey, Iraq, Syria, Lebanon, Jordan, Israel, and all of the Arabian peninsula except Kuwait, and through this so-called "Red Line Agreement" the partners agreed that any oil operations by any of the signers in the area would be jointly through Iraq Petroleum.

In 1948 Jersey and Socony wanted to join the Saudi Arabian oil concession held by Standard Oil Company of California and The Texas Company, the latter two not being signers of the Red Line Agreement. All stockholders of IPC agreed to a cancellation of the agreement except Gulbenkian, who threatened court action to block the move. After a personal appeal by the two American companies to Gulbenkian, and for a consideration, his objections were dropped.

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Charles E. Phillips

O. H. Berry and **Charles E. Phillips** announce the formation of **Berry and Phillips**, a consulting petroleum engineering firm, specializing in evaluation and management of oil and gas properties. Offices are in Midland, Texas. Berry was manager of production and chief engineer for The Vickers Petroleum Company, Inc., Wichita, Kansas. His professional experience includes four years as division engineer with Standard of Texas and two years as district engineer with Wilshire Oil Company, Inc., Midland. Phillips formerly was a consulting petroleum engineer associated with Robert W. Harrison & Company, Houston. Starting as a core analysis and mud logging engineer for Core Laboratories, Inc., he later went to Standard Oil Company of Texas where he was senior reservoir and reserves engineer for five years.

•

Lion Oil Company recently announced the addition of five new employes to the Rocky Mountain regional production and exploration staff. **Richard A. Struble**, formerly a geologist for Atlantic Refining Company, has become geologist in Lion's Denver district office. **Curtis J. Little** came to Lion as a geologist in the Casper, Wyo., district office. **Norman E. Smith** is landman at the Bismarck district office, and **Duane L. Roberts** has joined the company as production foreman at Fort Morgan, Colo. He was previously a branch manager of the National Tank Company. **Grover C. Williams** has joined the Colorado Production district as a drilling foreman at Fort Morgan after wide experience in oil well drilling operations in Colorado, Texas, Wyoming, Utah and Nebraska.

•

Oceanic Oil Company has announced the election of **LeRoy H. Hines** to the board of directors. Formerly with Standard of California, he resigned from that company as assistant to the vice president to assume the position of vice president of the Northern Pacific Railway Company in charge of oil development. Hines is now a petroleum consultant.

•

W. E. Hofstra has joined **Pure Oil Company** as staff geologist at Denver. He recently resigned as instructor in geology at New Mexico Military Institute.

•

Everett F. Brite, recently named vice president of **Skelly Oil Company**, also will remain in his present position as general auditor. Brite joined Skelly in 1922, was made assistant general auditor in 1936, and general auditor in 1953. He was formerly with Sinclair Oil and Gas Company.

Boren Oil & Gas Corporation has announced election of **Harold B. Ward**, independent of Tulsa, as a director and vice president in charge of Oklahoma operations. Ward resigned as manager of the land and geological department of Wilcox Oil & Gas Company in 1947 after 25 years of service. He has been an independent since that time.

•

A. W. Ball, superintendent of the Permian Basin Exploration division of **Phillips Petroleum Company**, has been promoted to regional staff geologist in the company's headquarters offices at Bartlesville. **Carl F. Lawrence**, exploitation supervisor for the Big Spring, Texas, and Hobbs, N. M., districts of Phillips, will succeed Ball at Midland. **Tom Curlee**, staff geologist at Midland, will be transferred to the Big Spring and Hobbs districts to replace Lawrence.

•

Helmerich & Payne, Inc., of Tulsa, has announced the appointment of **Don R. Weishaupt** as district drilling engineer for Oklahoma, Kansas and north Texas. He will headquarter at the company's Oklahoma City office. Weishaupt has served in the Production department of Shell Oil Company since graduating from the University of Oklahoma in 1948.

Don R. Weishaupt

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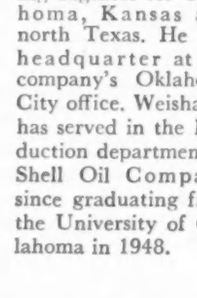
Robert C. Pomeroy, formerly pilot in the Mid-Continent division of **Sohio Petroleum Company**, has been promoted to assistant chief pilot reporting to the vice president, production. In this position, Pomeroy will pilot the new headquarters plane and will have flight staff supervision of all Production department pilots and aviation equipment.

•

Dr. John C. Calhoun, Jr., named dean of engineering for Texas A. & M. College, will head the engineering teaching, research and extension work of a major part of the A. & M. system, directing the School of Engineering at the college and the work of the statewide Engineering Experiment Station and Engineering Extension Service. He was formerly professor and head of the Department of Petroleum and Natural Gas Engineering at The Pennsylvania State University. Nationally recognized as a professional consultant, particularly in the field of secondary recovery, Calhoun has served as an independent consultant to many oil producing and exploration companies.



John C. Calhoun

William Naden, director and vice president of **Esso Standard Oil Company**, has been elected executive vice president. He succeeded **Marion W. Boyer** who has been elected a director of Standard Oil Company (New Jersey). Naden joined Esso 28 years ago as a chemist. From 1934 to 1944 he served successively as general superintendent of the Everett and Baltimore refineries. After a term as director of District 1, Petroleum Administration for War, he returned to the company as manager of employe relations and was elected a director in 1946. He became general manager of manufacturing in 1949 and was elected a vice president the following year.

William Naden

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Charles R. Criss, senior engineer for **Sohio Petroleum Company** at Oklahoma City, has moved to Centralia, Ill., as district engineer. He succeeds **Paul Luckhardt** who recently was transferred to the Okmulgee, Okla., area.

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Bob Hippard, named division exploration engineer at Odessa, Texas, for **Shell Oil Company**, replaces **Bob Brackbill** who was transferred to Midland, Texas, as production engineer.

•

Consolidated Petroleum Corporation has announced the resignation of **D. Laemmel** as secretary-treasurer and director of the corporation. At a recent meeting of the board, **Vincent L. Rohloff** was elected secretary; **Arthur S. Jones** treasurer; and **H. N. Mallon**, president of Dresser Industries, was named to the board of directors.

•

R. M. Churchwell, The Ohio Oil Company's division petroleum engineer at Casper, Wyo., has been appointed assistant chief petroleum engineer and will be located in the general office at Findlay, Ohio. **L. C. Powell**, division petroleum engineer at Terre Haute, Ind., will succeed Churchwell at Casper, and **R. N. Ayars**, assistant division petroleum engineer at Houston, will move to Terre Haute as division petroleum engineer. Churchwell joined Ohio Oil as a draftsman in 1941, advancing to petroleum engineer in 1943 and to division petroleum engineer in 1948. Powell became division engineer at Terre Haute in 1950 following assignments as district engineer in Michigan and Illinois. He joined the company in 1933. Ayars joined Ohio Oil as petroleum engineer at Bakersfield, Calif., in 1944. He advanced to assistant division petroleum engineer at Houston in 1952.

•

The Blackwell Oil & Gas Company has announced appointment of **H. Alan Nelson** as chief petroleum engineer. He was formerly associated with a petroleum engineering consultant firm in Oklahoma City and with Stanolind Oil and Gas Company.

J. L. Coulson

A. J. Evans

G. R. Meyers

Warren Petroleum Corporation's Oil division has announced the advancement of **J. L. Coulson** to the position of assistant production manager at Houston. He formerly was Warren's regional manager in the Abilene office where he had supervision of operations in north Texas, the Texas Panhandle and the basin area of West Texas. Coulson was employed by Warren six years ago as production superintendent at Wichita Falls. **A. J. Evans** has succeeded him at Abilene. With Warren for nine years, Evans most recently was assistant regional manager and drilling superintendent. **G. R. Meyers** has joined Warren as assistant regional manager. He formerly was production superintendent for J. J. Lynn. Meyers also has had previous experience with Stanolind Oil and Gas Company.

•

Stanley T. Crossland, vice president and treasurer, The Texas Company, and **Harry H. Arnold, Jr.,** formerly managing director N. V. Caltex Pacific Petroleum Maatschappij, Indonesia, have been elected to the board of directors of **California Texas Oil Company, Limited.** Crossland replaces **A. Neil Lilley,** director and vice president of The Texas Company, who resigned from the Caltex board. Arnold, a vice president of Caltex, has been re-assigned to New York in charge of the Producing division. Crossland joined Texaco January 1, 1955, in his present capacity. He was formerly vice president, treasurer and director of Ethyl Corporation. Arnold joined Texaco in 1927 as a geologist. In 1948 he became manager of the Rocky Mountain division. He was later appointed manager, Foreign Operations (Eastern Hemisphere) in New York. He joined Caltex in 1953.

•

William E. Davis, Jr., of Houston has joined **Gulf Coast Leaseholds, Inc.,** as executive vice president, responsible for directing fiscal and financial operations for the oil firm. Prior to joining Gulf Coast, Davis was assistant treasurer and head of the Treasury department of Schlumberger Well Surveying Corporation.

•

Willard F. Jones, vice president and general manager, Marine department, **Gulf Oil Corporation,** has retired. With the longest service of any employe of the company, 52 years, he began with Gulf in 1903 as a deck boy on a tanker under charter to the J. M. Guffey Petroleum Company, predecessor of Gulf. He was made vice president in 1949. **Carl F. Vander Clute** was named to succeed Jones.

Humble Oil & Refining Company has announced the following changes in Production department personnel: **G. L. Kempe,** senior petroleum engineer, East Texas division office, transferred to the West Texas division office; **W. B. Shields,** gas plant operator, 1st, Flour Bluff Gas Plant, promoted to roustabout gangpusher at the Tomball Gas System, Gulf Coast division; **T. V. Miller,** supervising petroleum engineer, Gulf Coast division, moved to Petroleum Engineering division, Houston office, as senior supervising petroleum engineer; and **N. N. Jones,** district superintendent, Means district, transferred to the California area as area superintendent. **M. V. Bates,** petroleum engineer, Equipment Engineering group, Southwest Texas division, has been transferred to Louisiana division office as senior petroleum engineer; and **Galyn D. Pownell,** junior petroleum engineer in the East Texas division office, and **Dan S. Ferguson,** junior petroleum engineer in the Hawkins district, East Texas division, have transferred to the Petroleum Engineering division, Houston.

•

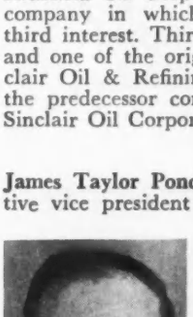
Earl D. Wallace has been elected a director of the **Middle States Petroleum Corporation.** Now a consultant with Dillon, Read & Company at New York, Wallace was formerly vice president of Standard Oil and Sohio Petroleum Companies.

•

Percy W. Thirtle, vice president of **Sinclair Oil Corporation,** recently retired from active executive duties after 39 years with the company. He will continue as a director of the corporation, as a director of Sinclair Oil & Gas Company, crude oil producing subsidiary, as well as director of Richfield Oil Corporation of California, a company in which Sinclair has a one-third interest. Thirtle was general auditor and one of the original organizers of Sinclair Oil & Refining Corporation, one of the predecessor companies of the present Sinclair Oil Corporation.

•

James Taylor Ponder's election as executive vice president of **Kin-Ark Oil Company** recently was announced. A member of the Secondary Recovery Association and a veteran of the oil and gas industries, he served seven years as general manager of Curtis A. Kinard's independent oil operations in Arkansas and Louisiana before the incorporation of Kin-Ark early this year. Activities of the company, centered in Arkansas, extend into Colorado, Kansas, Louisiana, Mississippi, Montana, North Dakota, Wyoming and Texas.



James T. Ponder

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C. B. Heartwell has been appointed superintendent, Gas and Natural Gasoline division, Southern district, Producing department, for **Standard Oil Company of California.** He succeeds **G. C. McLarren** who retired after more than 38 years with the company.

•

William D. Shea has been promoted to the Denver office of **Amerada Petroleum Corporation.** He was formerly petroleum geologist for Amerada at Williston and Dickinson, N. D.

Charles E. Webber has been appointed technical adviser to **J. G. Pew, Sun Oil Company** vice president in charge of production. **William Abnett** was named assistant technical adviser. He formerly was special assistant to the late James E. Pew, manager of Sun's Natural Gas division in which Webber was assistant manager. Webber will act as counsel to the various Production department divisions on natural gas and natural gasoline problems and projects. He was assistant director of the Petroleum Administration for War's Natural Gas and Natural Gasoline division in 1945 when he was named assistant manager of Sun's division. Abnett began his Sun Oil career in 1949 as special assistant to Pew.

Charles E. Webber

•

Shell Oil Company's North Texas Exploration division at Wichita Falls has announced the promotion of **J. H. Pittinger,** district geologist in Oklahoma City, to division exploration manager. **R. K. Mann,** district geologist, has been transferred from Wichita Falls to the division office in Oklahoma City. Pittinger joined Shell in 1949 as a junior geologist and in 1954 was named district geologist in the Oklahoma City division office. Mann joined the company in 1949 as a junior geologist and later became a geologist in the Wichita Falls office. He was promoted to district geologist in 1954.

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Tubokut Wireline Services - - - - - - - - 5-1811
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HOBBS
Horne Well Service Co. - - - - - - - - - 3-5396

HOUSTON
Adair Service Co. - - - - WA 3-6497, HU 6-3462

MIDLAND
Luccous Service & Equipment Co. - - - - 2-1631

PETTUS, TEXAS
Edward N. Jones - - - - - - 16 or Beeville 1547

OKLAHOMA CITY
Rainbo Service Co. - - - ME 4-2131, ME 2-3045

WICHITA FALLS
Hudson-Eads, Inc. - - - 2-3767, 2-8584, 3-4690

George J. O'Brien, vice president, Los Angeles area, **Standard Oil Company of California,** recently observed his 35th anniversary with the company. He first joined Standard as a member of a tanker crew, did refinery labor, spent years in sales, and ultimately became treasurer of the company. In 1941 he was appointed resident official at the Los Angeles headquarters as assistant to the president, and was named a vice president in 1943.

George J. O'Brien

Louis A. Newitt has begun a consulting practice in the San Antonio area. He was formerly geologist with Continental Oil Company.

•

Wayne L. McCann and **R. Lee Rogers, Jr.,** of Shreveport, are partners in a new petroleum consulting firm. McCann has been a consultant since 1953, formerly having been district engineer for Stanolind in Shreveport. Rogers was district geologist for the Murphy Corporation before resigning to join the new firm.

•

John Ed Cooper has joined the **BBM Drilling Company** of Houston as assistant to the president. He formerly was senior vice president, sales manager and member of the board of directors of The Western Company.

M. S. Metz has been named manager of **Shell Oil Company's** Houston area Exploration department. He replaces **Sherwood Buckstaff,** who has been assigned to the company's head office exploration staff in New York. Metz joined Shell in 1937 as junior geologist at Houston. He became senior geologist in Shell's Midland area in 1946, and in 1949 was named area geologist and then manager of the Exploration department in Calgary, Canada. He returned to Midland as area exploration manager in 1951 and has held that position until the present reassignment. A veteran of 30 years with Shell, Buckstaff has been manager of the company's Houston area Exploration department since 1948.

M. S. Metz

•

William R. Gray recently resigned as geologist-geophysicist for the Monterey Oil Company to open offices as consulting geologist in San Antonio. He formerly was with Sun Oil Company and Geophysical Service.

•

Jo Pat Black, former assistant to the president of the American Republic Corporation, has opened his own geology and geophysical consulting business with offices in the San Jacinto Building, Houston. He started his career in 1926 as a geophysical interpreter for the Calcasieu Oil Company. He joined Republic Production Company in 1934 in charge of their Geophysical department, and, following the merger of Republic into American Republic Corporation, became manager of the Geology and Lease division. He served as assistant to the president from 1952 until last year when American Republic Corporation was bought by the Sinclair Oil and Refinery Company. At that time he was also president of Republic Production Company of Texas, a subsidiary.

Jo Pat Black

•

William G. Pulliam, patent counsel of the **Cities Service Research and Development Company,** has been elected vice president of the company. He served as patent attorney, Cities Service Oil Company, from 1944 to 1947 when he was named patent counsel of Cities Service Research and Development.

•

Warren-Bradshaw Exploration Company recently named **Carl E. Stacey** production superintendent. Formerly division production superintendent of the West Texas-New Mexico division, Stacey is now headquartered in Tulsa. **J. C. Huff,** formerly district production superintendent of the Oklahoma-Kansas district, has been transferred to Levelland, Texas, to succeed Stacey as head of the division. **I. M. Parmer** was promoted to district production superintendent at Cushing to succeed Huff. Parmer formerly was district production foreman.

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THROUGH THE SHAKER SCREEN
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★ SEALS F-A-S-T-E-R
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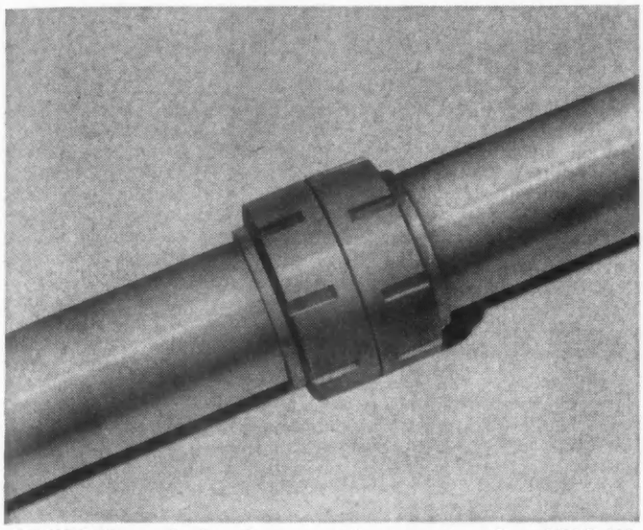
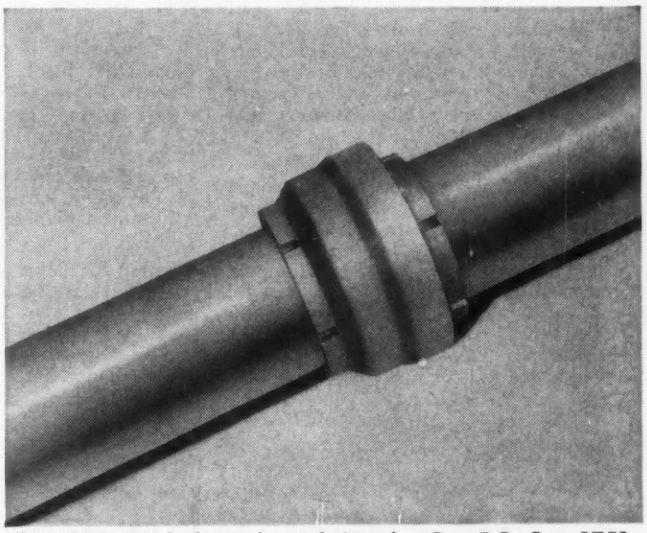
BRANCHES: MIDLAND, OKLAHOMA CITY, CORPUS CHRISTI, NEW ORLEANS, LAFAYETTE, LA., CASPER



COUPLER made by Gateway Engineering Co., 3233 W. Grand Avenue, Chicago 51, Ill.



COUPLER made by Industrial Coupler Co., P.O. Box 1751, 4218 Boone Ave., Spokane, Wash.

num worked closely with these manufacturers in the design of the couplers.

They are all cast aluminum and require no welding. Instead, they are designed to engage the flared or flanged ends of the aluminum pipe sections with O-ring or molded type neoprene gaskets, seated in the coupler bodies by means of threaded locking nuts.

The locking nuts require only hand pressure with 6" spanner wrenches to guarantee leakproof connections at liquid or gas pressures from 0 to 1,000 psi.

The couplers provide highly flexible connections, permitting pipe to be laid around obstacles and over rough country without special equipment.

Flanging of the pipe can be accomplished either by power machinery in a shop or by hand tools in the field. This field flanging, plus the fact that no welding is required, permits quick and easy manifolding simply by cutting the tube to the desired length, slipping coupler over the tube, flaring the end and connecting.

Kaiser Aluminum petroleum pipe is roll-formed and induction welded from high-strength aluminum alloy sheet. It is available now in 30-foot lengths of 2, 3, and 4 inches diameter. Outside and inside surfaces are clad with high-purity aluminum to increase resistance to corrosion.

The pipe has a design pressure of above 1500 psi, with a guaranteed test pressure of 1000 psi, and a recommended operating pressure of 500 psi, providing a nominal safety factor of 3 to 1.

New Kaiser Aluminum petroleum pipe and the detachable couplers are available from your nearby supplier.

For more information, contact the Kaiser Aluminum sales office listed in your telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, California.

Kaiser Aluminum

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DEATHS

John H. Kane, 80, attorney and former executive vice president of Phillips Petroleum Company, died July 6 in Bartlesville, Okla. He had served as executive and director of numerous oil companies and banking institutions.

Rex P. Grant, 50, assistant state geologist and head of the Oil and Gas division, Michigan State Department of Conservation, died July 25 at Lansing, Mich. He was a former president of the Michigan Geological Society and had served as vice president of the Michigan Oil and Gas Scouts Association and was a member of the American Association of Petroleum Geologists.

L. I. Brockway, 44, chief geophysicist, Western Gulf Oil Company, died recently in Bakersfield, Calif. He had just concluded his twentieth year with the company and was secretary-treasurer of the Pacific Section of S.E.G.

Robert W. Black, safety engineer for the Esso Standard Oil Company since 1930, died July 3 at Downers Grove, Ill. Joining the company in 1920, he administered the company's safety program in the marketing and manufacturing operations and was an advisor on safety and fire prevention to affiliate companies.

Chester S. Bleyer, formerly supervisor of joint interests for Sinclair Oil Company, died August 1 at Williams, Ariz. He had been with Sinclair since 1919 and had retired only four days before. His home was in Tulsa.

William H. (Bill) Atcheson, 49, Tulsa district advertising manager of The Gulf Publishing Company, was killed in Kansas City August 14 by a propeller of an airliner. Atcheson had debarked from a Minneapolis-bound plane only minutes before his death. Airline officials said he apparently mistook the departing plane to be his scheduled flight. Very nearsighted and minus his glasses, which he had left in the terminal, he dashed onto the field and into the path of the taxiing airliner. A veteran of 34 years with the company, Atcheson began as an office boy in the Houston office when only 15 years old. He later saw service in the Editorial, Printing Sales and Advertising departments, transferring to Tulsa in 1947 as district advertising manager. Survivors include his wife, Dorothy, and three children, Dick, 21; Bob, 16; and Mary Ellen, 9.

W. H. Atcheson

Charles A. Mechling, 75, retired oil operator and a founder of the old Hinderliter Tool Company, died August 12. He entered the oil business as a machinist foreman for the Oil Well Supply Company in West Virginia.

Robert G. Cole, 39, long-time employe of Orbit Valve Company, died in Tulsa July 24. With the firm since 1941, he had been sales manager since December, 1951.

Dr. I. Arthur Anson, 67, president of the Ben Franklin Refining Company and vice president in charge of manufacturing for Bell Oil and Gas Company, died June 10. He was an outstanding civic leader and scientist, as well as author of numerous papers on engineering and general subjects.

Dee A. Sikes, 54, vice president in charge of drilling contracts and publication, Helmerich and Payne, Inc., died June 24. Once advertising manager for the Pasadena, Calif., Morning Sun, he later joined Baroid Sales Division of National Lead Company. He joined Helmerich and Payne, in 1949.

Bernard A. Montgomery, 51, staff executive of the Accounting department of Cities Service Company, died in Kew Gardens, N. Y. He joined the Cities Service organization in 1925 as general clerk and teller in the cashier's department.

James E. Pew, 54, member of the board of directors and manager of the Natural Gas and Natural Gasoline division of Sun Oil Company died June 19 in Malvern, Penn. For many years he was president of Sun Shipbuilding and Dry Dock Company and before that, president of the Peoples Natural Gas Company in Pittsburgh. He was a grandnephew of the founder of Sun Oil Company.

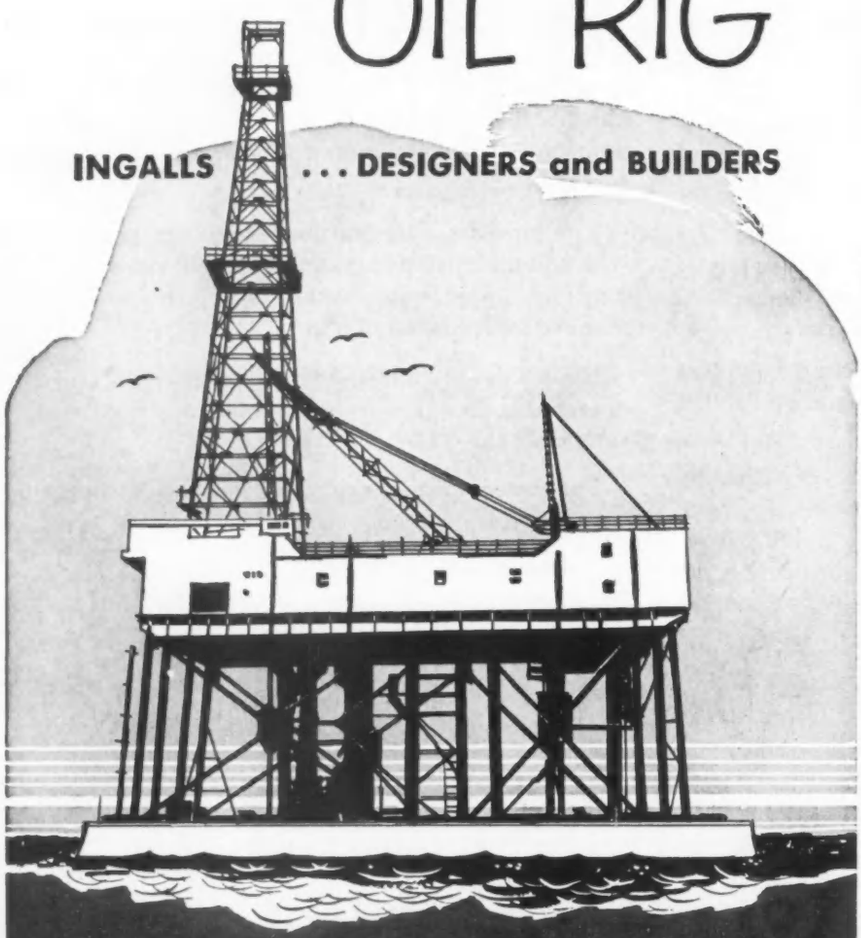
Burr Lambert, 57, oil operator and drilling contractor, died in Evansville, Ind., June 30. He had been active in oil activities in Oklahoma, Texas and Illinois before going to Indiana in 1937.

King Gaines Gillett, 64, former president of the Golden West Petroleum Company, died recently in Newport Beach, Calif.

Everett H. Robertson, 55, California and Texas oilman, died July 24 in Los Angeles. He was president of Suniland Oil Company which recently acquired an interest in the Wilshire Oil Company.

Seagoing OIL RIG

INGALLS ... DESIGNERS and BUILDERS



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The INGALLS Shipbuilding Corporation

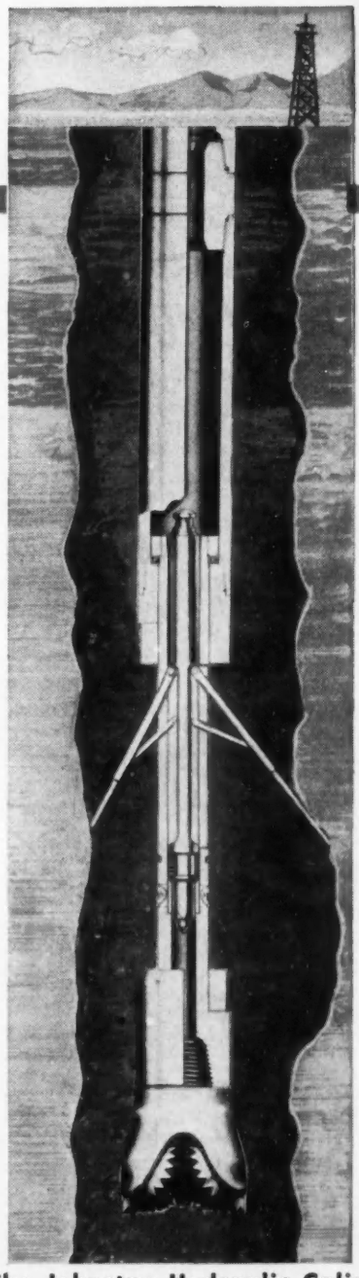
BIRMINGHAM, ALABAMA

"Like getting the hole calipered FREE!"

...as a driller said recently.

Here's why no other caliper can match the

Johnston Hydraulic HOLE CALIPER



The Johnston Hydraulic Caliper provides accurate information on hole diameter from bottom to top. Information you can use with confidence.

Whatever the hole condition, you can be sure of getting a complete picture with the Johnston Hydraulic Caliper!

Saves time! No need to stop and rig up wire line. No delay or difficulty in crooked or directionally drilled holes.

Saves money! The *only* hole caliper that can often pay the cost of calipering in savings in rig time. The Johnston Hydraulic Hole Caliper is dropped into the drill pipe just before pipe is removed. Measures and records hole diameter as pipe is pulled from hole. Pipe may be rotated out in normal manner.

Accurate! Records continuous diameter of hole, bottom to top, either at detail speed or normal charting speed. Each measuring arm functions independently assuring the accurate measurement of irregular shaped hole.

Measures from the bottom! With the Johnston Hydraulic Hole Caliper, you can always be sure of starting to measure at the bottom every time.

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CONVENIENT STICKS OR BULK

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What's Happening

AMONG INDUSTRY ASSOCIATIONS

Desk and Derrick Officers Installed in Los Angeles

Mary Pancoast, American Petroleum Institute, was installed June 21 as president of the Los Angeles Desk and Derrick club for the coming year. Other officers elected and installed were Ann Beyerly, General Petroleum Corporation, first vice president; Alphonsine Ring, Daniel Orifice Fitting Company, second vice president; Edna Lou Prange, Humble Oil & Refining Company, recording secretary; Harriette E. Gilmore, Conservation Committee of California Oil Producers, corresponding secretary; and Gladys Hart, Richfield Oil Corporation, treasurer.

Faye Jordan, R. J. Eiche & Associates, and Flora A. Monahan, Signal Oil and Gas Company, have been elected directors for a two-year term. Gladys Hodgkinson, Lloyd Corporation, Ltd., and Margaret Martin, Baker Oil Tools, Inc., will continue as directors for another year.

Panhandle Geologists Reschedule Field Trip

The field trip to the Dry Cimarron River Valley and lower front range of the Rocky Mountains, originally scheduled by the Panhandle Geological Society for May 19-21, will be held September 15-17. The trip will start at Boise City, Okla.

Wise Elected President Of Geological Society

Roscoe E. Wise, Sun Oil Company, has been named president of the Illinois and Kentucky Geological Society for 1955-56. R. C. Stouder, Stouder Drilling Company, was elected vice president, and James Smith, Phillips Petroleum Company, was elected secretary-treasurer. Other members of the executive committee include Tom Ritter, Sun Oil; W. W. Hogan, independent; and R. B. Sublett, W. C. McBride, Inc., immediate past president.

Attend Golf Party

Taking part in the semi-annual golf party held recently in Dallas by the Dallas-Fort Worth Nomads were Frank Morrow, British-American Oil Company; Herschel Lewis, Emsco Manufacturing Company; Howall Adair, Sun Oil Company; and Don Monnett, Magnolia Petroleum Company.

ASME Oil Division to Hold Conference in New Orleans

Panel discussions on mechanics of bulk oil measurement, the ASME unfired pressure vessel code and the ASA B31 piping code will highlight the American Society of Mechanical Engineers tenth annual Petroleum Engineering Conference to be held in New Orleans September 25-28. The conference is sponsored by the Petroleum division of the society with the cooperation of the New Orleans section.

Thirty-two technical papers and the three panel discussions will be presented during the conference, covering the activities of the manufacturers, materials, production, refining and transportation groups within the division. A tour of the Shell Oil refinery at Norco is scheduled for September 29.

Visitors Attend Houston Meeting

Visitors attending a recent meeting of the Houston Chapter of the Nomads were (seated, left to right) Lucien Weltzer, French Equatorial Africa Oil Company, Paris; John Chestnut, consulting engineer, Los Angeles and H. J. Veenink, NNGPM, Sorong, New Guinea. Standing, left to right, are Jake Aston, Horton Equipment Company; Frank Simms, Socony Mobile, Caracas, Venezuela; Bill Dudley, The Gulf Publishing Company; Darrell Lawless, Horton Equipment Company; John Shirley, Ralph M. Parson Company, Ankara, Turkey; W. J. Green, Reed Roller Bit Company; A. H. Manson, Asiatic Petroleum Company; Harold Hall, Reed Roller Bit; J. L. Lloyd, Shell Oil Company, Caracas; William M. Laird, Hardy-Griffin Engineering Corporation; Pierre Lichtfouse, French Equatoria Africa Oil; and M. A. Roca, LaPaz Bolivia.

Always say Worthington — for Quick Delivery!

"Here comes your QD Sheave — the original two-piece design."

It's there in a flash when you order a QD sheave or V-belt from your local Worthington distributor or supply store!

QD, by the way, also stands for "Quick Detachable." The Worthington QD sheave is easy to get on, easy to get off — but always stays tight on the shaft. It's the *original* two-piece sheave.

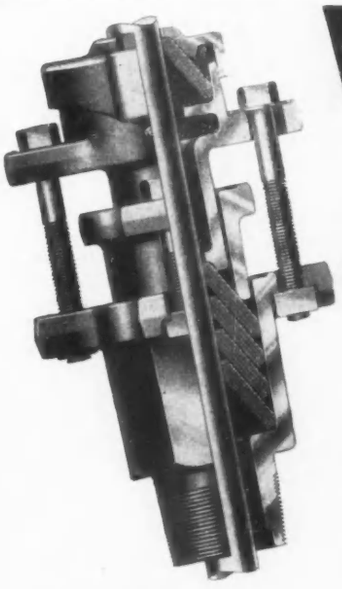
Try your Worthington man or supply store next time you need a sheave or V-belt. You'll see why QD means Quick Delivery. MV.5.11

WORTHINGTON

Buy These Worthington Standard Products From Your Local Distributor

COMPRESSORS • MULTI-V-DRIVES
VARIABLE SPEED DRIVES • PUMPS

For a BETTER production job use HERCULES STUFFING BOXES



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"REGULAR TYPE"
DUPLEX POLISHED ROD
STUFFING BOX

2
"TEE BASE TYPE"
DUPLEX POLISHED
ROD STUFFING BOX-TEE

All Hercules Stuffing Boxes are made of high grade malleable iron which prevents shattering if rods drop. They are tested to 3,000 pounds psi pressure and all use the famous Hercules split cone packing rings.

3
"TYPE DP"
DUPLEX POLISHED
ROD DOUBLE PACKED
STUFFING BOX

1
The old reliable, tried and proved in thousands of wells from coast to coast and for many years.

2
A combination Stuffing Box and Pumping Tee. Makes a short connection and bolt lugs on body placed low to prevent fouling elevator links, No Bell Nipple needed as top of body will support elevator. Full opening — unnecessary to remove body when pulling or running rods.

3
Designed for use on wells that flow intermittently and is especially desirable for wells located near buildings, fire hazards or growing crops. Two compression bolts, in bottom sections are tightened on Cone Rings to pack-off while replacing packing in upper section.

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DESIGNED AND RECOMMENDED *By the men who use them*

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SINCE 1924

Manufacturers of Oil Field Equipment

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. • 30 Church Street, New York, N. Y.

Hold Annual Outing

A golf tournament opened the sixteenth all-day outing held recently in Whittier, Calif., for Los Angeles Nomads and guests. Golf prize winners included, left to right (back row): G. R. Winder, Chiksan Company; Jay Curts, Gulf Publishing Company; Jack Augsberger, Triad Service; Bill Huskey, Hillman-Kelley; Karl Krieger of Richfield. Front row, left to right, are Howard Hoon, Hydril Company; Truman Beeson, Specialty Sales Company; Howard Kaylor, Creole Petroleum Corporation; Paul Bowen, S. R. Bowen Company; and Gene Madsden, H. C. Smith Oil Tool Company.

API Production Division To Establish New Districts

Effective September 1 the American Petroleum Institute's Division of Production will establish two new districts to broaden the base of its activities in the Southwestern U. S.

A. W. Thompson, of A. W. Thompson, Inc., the API's vice president for production, said that one new district will be Southern, which will include the Texas Gulf Coast, east, south and southwest Texas, and Louisiana, Arkansas and Mississippi. The other will be Southwestern, to include west, west central and north Texas and New Mexico. The new districts cover the same territory as was previously included in a single district.

"This action," Thompson said, "recognizes the many differences between typical Gulf Coast and Permian Basin operations, and reduces the great distances which were a handicap in operation of the formal district, the boundaries of which had gone unchanged for nearly 30 years. In this interval, new and important oil capitals and producing areas have sprung up, for example, Midland-Odessa, which were far from the center of the district and thus hard to integrate in its activities.

"One advantage which will eventually result from the new arrangement," Thompson said, "is increased individual participation in API committees and projects, particularly in the Midland-Odessa, Abilene, San Angelo, Hobbs, Wichita Falls, Beaumont, Lake Charles, New Orleans, Shreveport and Jackson areas. Other advantages are increased proximity of all cities to the annual district meetings and greater freedom to adapt API technical and operating studies to the specific problems of a given area."

Thompson stated that each new district would meet for the first time in 1956: the Southern district on March 7-9 in San Antonio, and the Southwestern district in Fort Worth March 21-23. Meanwhile, a number of standing committees are being set up in each district to carry on the API programs of personnel development and drilling and production practice studies.

At the same time Thompson announced that Alden Donnelley, vice president of the Honolulu Oil Corporation, Midland, Texas, had been appointed the first chairman of the Southwestern district and R. M. Hayes, division production superintendent, Phillips Petroleum Company, Midland, the chairman of the district's Advisory Committee.

Chairman and Advisory Committee chairman, respectively, of the Southern district will be T. J. Fuson, Humble Oil & Refining Company, and S. C. Oliphant, Tennessee Gas Transmission Company, both of Houston.

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COMPETITION is the lifeblood of American business. Competition provides everyone with new opportunities. Competition makes oil well cementing service better, too. On your next cementing job, call in the company that has made great new advances in engineered answers and equipment.

Engineered answers to oil well cementing

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BE PREPARED FOR MUD HEADACHES...

Have Driscose Handy!*

Whatever mud formula you plan to use, always be sure to include **DRISCOSE** in your initial chemical order. **DRISCOSE** in your rig mud house is like keeping aspirin in the medicine chest. When sudden drilling mud headaches occur, such as high water loss or settling weight material, you can usually cure these conditions quickly and save valuable operating hours by using fast-acting **DRISCOSE**.

DRISCOSE forms a strong, thin filter cake; cuts water loss. Gives you the very best in thixotropic and suspension qualities; good control of viscosity and gel. It's a fine lubricant, too. Order **DRISCOSE** today from your mud dealer.

DRILL WITH

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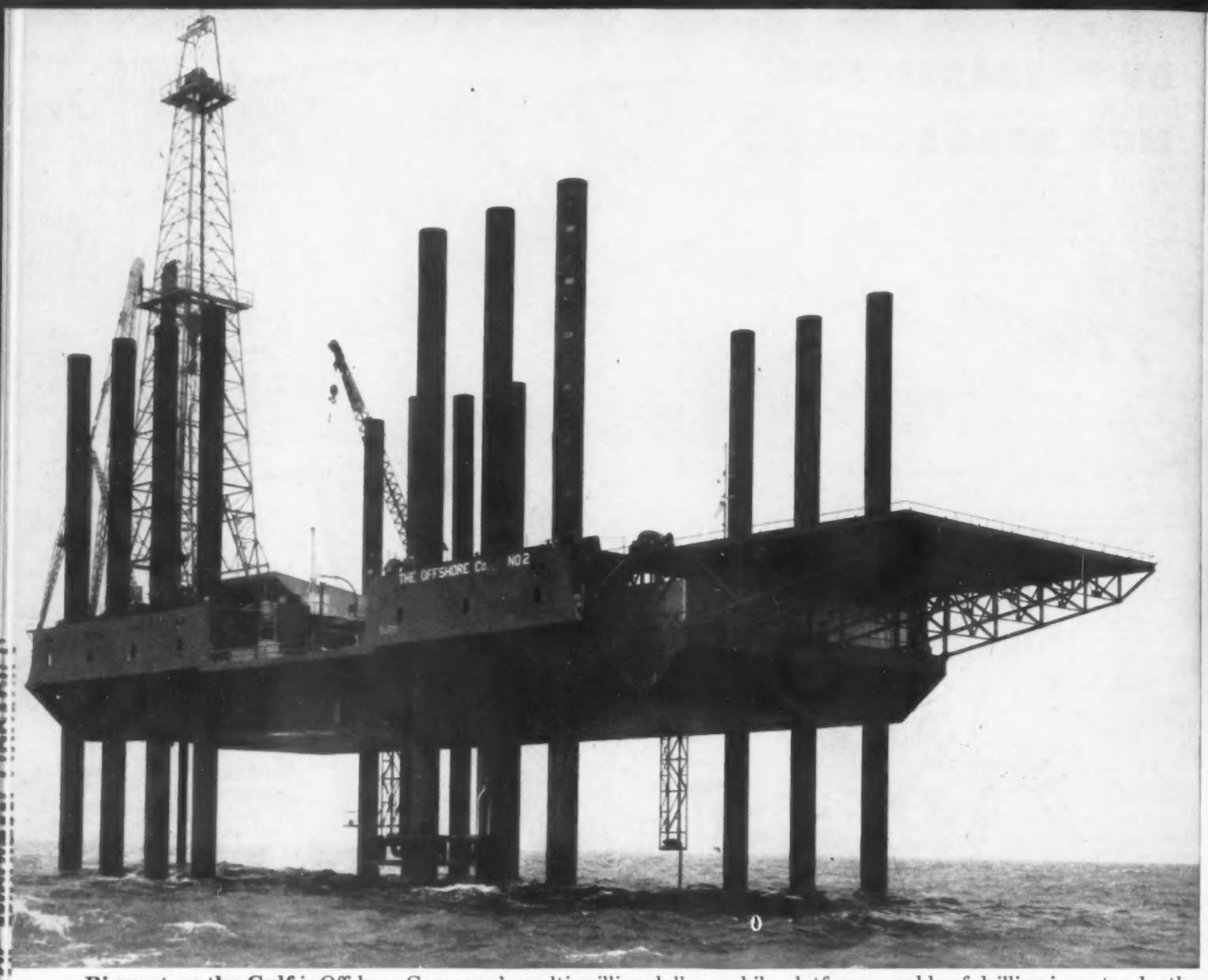
DRILLING SPECIALTIES COMPANY BARTLESVILLE, OKLAHOMA

*DRISCOSE is a trademark for Sodium Carboxymethylcellulose.



Biggest on the Gulf is Offshore Company's multi-million dollar mobile platform capable of drilling in water depths of 100 feet to explore for the rich oil and gas reserves of the Miocene Trend miles below the ocean floor.

The Big Wildcatters Are Choosy

Where they're playing for million-dollar stakes, oilmen count on Pittsburgh Steel Company's seamless oil country goods to help lower the odds.

Offshore Company's $3.8 million mobile platform No. 2 is the largest entry in the sweepstakes for the rich oil and gas reserves below the ocean floor in the Gulf.

This ocean-going monster weighs as much as a tanker and has deck dimensions slightly smaller than a football field. It carries a 146-foot high drilling rig on its back, is generously equipped for fast drilling, and has first-class crew quarters.

When it moves into position, its fourteen sea legs are lowered and air-jack driven into the ocean floor. Each is a 6-foot diameter steel caisson, 200 feet long and weighing 100 tons. Then the barge climbs up the caissons until it is at a safe operating level above water, and begins drilling.

Once on location its towering framework can be battered by hurricane winds and lashed by waves. Yet it won't budge. Its powerful drilling equipment is built to stab through miles of earth beneath the ocean to reach pay quickly.

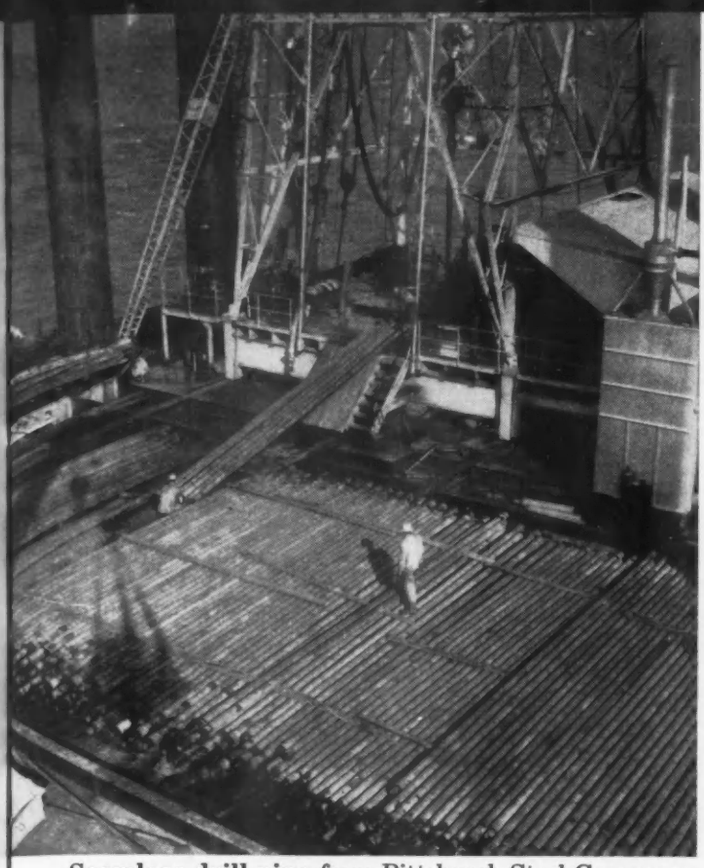
When you consider the large investment and heavy costs involved, you can understand why oilmen who operate equipment such as this can't afford to take chances on equipment or service.

The pay-off comes on the footage of hole drilled. All time and expense that does not deepen the hole, lowers profits. Equipment failures or service delays pile up losses rapidly.

The fact that this rig is equipped with Pittsburgh Steel Company's seamless drill pipe is a credit to the quality of the product. To oilmen who have relied on Pittsburgh seamless for more than a half-century, its selection is not surprising.

Offshore No. 2 is using 5-inch OD Grade E Range 2 drill pipe. It has a minimum yield strength of 75,000 psi, and needs every pound of it.

Rotating at 120 rpm and drilling an average of 500 feet of hole a day, as it was on the operation shown



Seamless drill pipe from Pittsburgh Steel Company, racked on the barge deck, is fed length by length into the hole as it deepens in the race to reach pay.

High above the ocean a derrick man stabs a stand (three 30-foot lengths) of drill pipe into the hole. This pipe goes in at better than a stand a minute.

here, the drill pipe at the top of the hole may be under a tension of well over 100 tons. It is subject to continuous fatigue and torsion. Abrasive and corrosive wear also are always present.

Pittsburgh seamless, along with other equipment for Offshore No. 2 was supplied through one of the independent distributors listed at right. The selection of an independent to provide the fast and flexible service needed for a rig such as this was natural.

As the barge reached its finishing stages prior to launching, the independent's field representative stood by on 24-hour alert. The mobile telephone in his car was busy with calls to his warehouse for instant delivery of required parts.

Now he calls regularly at the dock from which the rig is serviced, continuing his 24-hour, 7-day a week vigil to cut any costly delay that might occur. He provides the same experienced, personal service—free from red tape, cluttering paperwork, and remote control—that is the specialty of all independents on the list.

The next time you need a string of drill pipe, casing, or tubing, why not get the pipe of your choice through the supplier of your choice? Specify Pittsburgh seamless!

Home Offices

Bradford Supply Company
130 Main Street
Bradford, Pennsylvania

Buckeye Supply Company
18 Harrison Street
Zanesville, Ohio

C. W. Cotton Supply Company
Utica National Bank Building
Tulsa 5, Oklahoma

Franklin Supply Company
624 South Michigan Avenue
Chicago 5, Illinois

Houston Oil Field Material Co.
1524 Maury Street
Houston, Texas

Industrial Supply Company
500 Eighth Street
Wichita Falls, Texas

Iverson Supply Company
400 West Fifth Street
Tulsa, Oklahoma

Lucey Export Corporation
233 Broadway
New York 7, New York

Lucey Products Corporation
624 South Cheyenne
Tulsa 19, Oklahoma

McJunkin Corporation
P. O. Box 513
Charleston 22, West Virginia

Midland Supply Company
Box 3105
Washington St. Station
Wichita 7, Kansas

Mountain Iron & Supply Co.
100 Rule Building
Wichita 2, Kansas

Murray Brooks, Incorporated
P. O. Box 855
Lake Charles, Louisiana

Norvell Wilder Supply Company
P. O. Box 4145
Beaumont, Texas

Producers Supply & Tool Co.
706 Commercial Standard Bldg.
Fort Worth 2, Texas

Rodman Supply Company
P. O. Box 2752
Odessa, Texas

Southwest Supply Company
1720 Oliver Building
Pittsburgh, Pennsylvania

Superior Iron Works & Supply Co.
P. O. Box 1800
Shreveport, Louisiana

Western Supply Company
424 North Boulder Avenue
Tulsa 1, Oklahoma

Pittsburgh Seamless Oil Country Goods . . . *a product of*

Pittsburgh Steel Company

Grant Building • Pittsburgh 30, Pa.

DISTRICT SALES OFFICES: Atlanta • Chicago • Cleveland • Columbus • Dallas Dayton • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh San Francisco • Tulsa • Warren, Ohio. PLANTS: Monessen, Pa. • Allenport, Pa. Akron • Los Angeles • Unionville, Conn. • Warren, Ohio • Worcester, Mass.

Companies in the News

COMMONWEALTH OIL COMPANY, following stockholder approval of a stock transaction transferring control, has named **G. Burton Liese** of Houston president and has elected a new board of directors. Headquarters of the company will be moved from Miami to Houston. The Marine Gathering Company, of which Liese also is president, became a wholly-owned subsidiary of Commonwealth under terms of the reorganization. Officers of Commonwealth are Liese, **Byron L. Ramsing,** chairman of the board, **J. L. McCord** and **Alvin S. Moody,** vice presidents; **R. E. Rickett,** treasurer; and **R. C. Ledford,** secretary. Directors include Liese, Ramsing, McCord, Moody, **John H. Blaffer, Thomas H. Anderson, Donald M. Lovejoy, Harold S. Burrow** and **W. Browne Baker.** The company will drill for oil and gas in Haiti, the Florida Everglades and offshore around the Florida Keys.

•

O. E. HALL DRILLING COMPANY has moved from Wichita Falls, Texas, to Fort Worth. Their new offices are located at 1890 Electric building.

Harry Dernick

Jack W. Hudson

PRODUCTION MANAGEMENT, INC., with headquarters at 351 Colorado National Bank building, Denver, has been formed by **Jack W. Hudson** and **Harry Dernick.** The company will offer property management and engineering services for natural gas and oil producing properties in the Rocky Mountain area, Denver-Julesburg and Canada. Services will include producing property management, supervision of drilling and development programs, evaluation and appraisal of properties, design of gas gathering systems, consultation on natural gas contracts and complete production analyses for property owners. Hudson, president, was formerly general superintendent with Deep Rock Oil Corporation. Prior to joining Deep Rock, he was with Republic Natural Gas Company as general superintendent of the oil and gas divisions. Dernick, vice president, was formerly assistant chief engineer in charge of oil and gas engineering and evaluation for Deep Rock. He also worked for Republic, Conroe Drilling Company and Heep Oil Corporation.

•

MONSANTO CHEMICAL COMPANY and **LION OIL COMPANY** have signed an agreement of merger of Lion with and into Monsanto, which will be submitted for approval to stockholders of the two companies September 23. The Lion organization, which will be continued if the merger is approved, will be known as Lion Oil Company, a division of Monsanto Chemical Company. **T. M. Martin,** now president of Lion, will continue as president of the Lion division. He and **T. H. Barton,** Lion's board chairman, will become members of the Monsanto board. The companies plan a long range program of producing an increasing variety of chemical raw materials.

•

SHELL OIL COMPANY has awarded contracts for construction of a modern office building in Ventura, Calif., to house the Coastal division. More than 25,000 square feet of floor space will be available in the new building providing offices for Production, Exploration and Land departments. Completion is estimated by mid-1956.

•

BISHOP OIL COMPANY is opening new district offices in Abilene, Texas, and Denver. Its office in Midland, Texas, is being closed. **Burr Roberts,** senior geologist formerly stationed at Midland, will head the new district office at 620 Farmers' Union Building, Denver. The new office at 117 Garrison building, Abilene, will be in charge of **Kenneth E. Boling,** Bishop production superintendent formerly at Midland.

Be Safe — — Be Sure

AR Wire Line Stripper
Latch Collar not shown

YOU ALWAYS HAVE
CONTROL
with a KING
Wire Line Stripper (Auto-Releasing)

POSITIVE LATCH
will not release by accident or surge of pressure.

SURE RELEASE MECHANISM
operated by rope socket striking bottom of stripper.

NON-SPARKING MATERIALS
eliminate hazard of fire from this tool.

CONVENIENT HAND HOLDS
makes for easier handling at all times.

SIDE OPENINGS
permit repacking while the wire line is in the hole.

These wire line strippers represent an outstanding advance in design and construction of tools in this class.

Sometimes referred to as "wipers" or "oil savers", they provide the oil industry many advantages that were not previously available.

Export: R. S. STOKVIS & SONS
17 Battery Place, New York 4, N. Y.

KING OIL TOOLS
7944 DOCKAL ROAD • HOUSTON, TEXAS • ORchard 3-3421

NEW and EXCLUSIVE . . .

"ABSOLUTE CALIBRATION STANDARD"

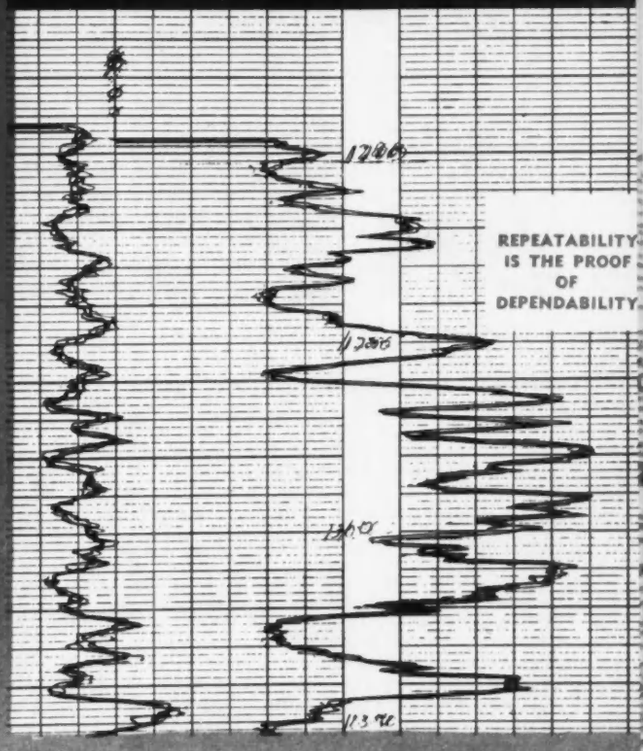
FOR SIMULTANEOUS RADIATION LOGGING

Here you see a typical example of four separate PGAC logging runs in the same well — with the original records superimposed to **prove** the Repeatability of PGAC logs.

But here is the important point. Each of these four runs was made with a **different** radiation source, the strengths of which varied as much as 17%. Nevertheless, see for yourself the striking accuracy of these four logs under PGAC's new **Absolute Calibration Standard!**

With this **new** and **exclusive** PGAC development, a more dependable radioactive log of your well — capable of Repeatability like that shown here — is always obtained . . . regardless of which logging crew, which instrument, or which radiation source may be used. Don't you agree that such repeatability—both quantitatively and graphically — **speaks for itself?** That's why so many operators say: "If you're over oil, PGAC always gets **more** of it, and at less cost!"

PGAC SIMULTANEOUS RADIATION LOG



PGAC 54

The technical story of this PGAC development is too complex to present here. But you are welcome to write for the complete and fully illustrated article **"Quantitative Evaluation."** This report will be gladly sent to you free of charge, and without obligation of any kind. Be sure and write our Houston office today. We'll be looking for your request!

PGAC PERFORATING GUNS ATLAS CORPORATION

Houston, Texas Telephone: JAckson 9-4161
General Offices and Main Plant: 7730 Scott Street — Sales Office: Melrose Building

35 PGAC OFFICES ALWAYS READY TO SERVE YOU . . . CALL THESE TELEPHONE NUMBERS FOR PROMPT SERVICE

TEXAS: Houston, JA-9-4161 — Corpus Christi, TU-3-1324 — Dallas, RA-2943 — Longview, PL-9-4486 — Alice, 4-3424 — Abilene, 2-4172 — Wichita Falls, 2-7151 Gainesville, HO-5-2501 — Odessa, 6-6428 — Beaumont, 2-4263 — Victoria, HI-5-1972 — Graham, 1728 — Pampa, 4-9932 — Colorado City, 790
LOUISIANA: Shreveport, 3-1648 — Lake Charles, HE-9-4724 — Lafayette, 4-2396 — Houma, 2-2771. KANSAS: Great Bend, 4306 — Liberal, 4822
OKLAHOMA: Oklahoma City, CE-2-5342 — Pauls Valley, 1577 — Seminole, 2938 — Healdton, 77 — Ardmore, 857 — Perry, 313. NEW MEXICO: Hobbs, 3-2015

AFFILIATE COMPANIES: CANADA — Perforating Guns of Canada, Ltd.; Edmonton, Alberta
GERMANY — Atlas Deutsch- Amerikanische Olfelddienst G. m. b. H.; Kiel VENEZUELA — Servicios Tecnicos Atlas, C.A., Caracas

What's Happening

AMONG SERVICE AND SUPPLY MEN

E. M. Connor

R. E. Kimsey

R. W. Lewis

H. M. Kelly

F. T. Alexander

Gayle Whiddon

A. H. LeBleu

Shelby Chambless

G. S. Lawrence

Norman J. Clark

W. P. Schultz

William D. Kent

Hughes Tool Company has announced completion of a two month's program of promotions and transfers. Hughes men now in new assignments are **E. M. Connor,** regional manager, Western division, Midland, Texas; **R. E. Kimsey,** western regional sales consultant, Midland; **R. W. Lewis,** special tool joint representative, General Sales department, Houston; **H. M. Kelly,** West Texas-New Mexico division sales manager, Midland; **F. T. Alexander,** South Louisiana district sales manager, Lafayette; **Gayle Whiddon,** Northern regional special representative, Tulsa; **A. H. LeBleu,** Southern regional special representative, Houston; and **Shelby Chambless,** Ark-La-Tex division special representative, Shreveport.

Diamond Bit & Coring Company has announced the addition of **G. S. Lawrence** to their staff. He will be in charge of diamond wire line coring, a new service being offered by the company. Lawrence is a veteran of 30 years in the oil fields, having been employed by Magnolia Petroleum Company and, for the past 11 years, by A-1 Bit & Tool Company.

Core Laboratories, Inc. announces the association of two petroleum engineers as new members of the Engineering and Consulting department. **Norman J. Clark,** formerly supervisory reservoir engineer for Humble Oil & Refining Company, has been appointed assistant manager of the Engineering and Consulting department under the direction of W. L. Horner, vice president. Since 1945 Clark has been engaged in reservoir engineering involving major detailed and comprehensive studies on oil and gas fields and the development of engineering methods. **W. P. Schultz,** senior petroleum engineer, was employed by Humble Oil from 1947-1955, specializing in studies of oil and gas processing plant design. He also served as instructor in reservoir engineering to Humble engineers and supervisors.

William D. Kent, recently appointed sales engineer of **S&R Tool and Supply Company,** will represent S&R in sales and service on all types design and fabrication of oil country and industrial equipment. Before joining the company, he was consulting engineer and manufacturers' agent for pneumatic and hydraulic equipment applications.

Taylor Instrument Companies has appointed **Alvin J. Fink** assistant regional manager in charge of industrial sales operations for Los Angeles and the Intermountain territory. With the company 30 years, he has had wide training in instrument manufacturing as well as sales. Since 1939 he has been in charge of industrial sales in the company's Los Angeles office.

Jess A. McMurry, named director of branches for **Crane Co.,** will have responsibility for operation of all activities of Crane's field organization. McMurry joined Crane in 1917 and was appointed manager of the New Orleans branch in 1940. He has been a district manager since 1945. Replacing him at Dallas is **R. G. Hunter,** former manager of the Tulsa branch. Hunter has been with Crane since 1925.

James H. Joyner, named manager, Pacific Coast sales, Quaker Pioneer Rubber Mills, Division of **H. K. Porter Company, Inc.,** has been with Quaker Pioneer as manager, Los Angeles branch, since their acquisition by H. K. Porter Company in 1954. He previously had served Quaker Rubber Corporation as salesman and manager of the St. Louis branch. His new duties will include supervision of Quaker's sales personnel and activities in ten Western states.

J. E. Vogt has assumed the duties of secretary-treasurer of **American Iron and Machine Works Company, Inc.** Employed by American Iron in 1949, he has been serving as controller.

Maurice E. Hanson, former area manager for **Dowell Incorporated** at Wichita, recently was transferred to Houston as service supervisor. He will be responsible for coordination and supervision of Dowell's oil field services in the Texas Gulf Coast district. Hanson joined the company at Great Bend in 1945 and since has been service engineer, development engineer, district sales engineer and area manager in the company's Kansas district.

Magnet Cove Barium Corporation has announced the following promotions in the Sales and Service department: **John E. Lyons,** named sales coordinator, started with the company in 1946. Since 1954 he has been a special sales representative in Houston. **Arvel C. Smith,** former division sales manager with the Mid-Continent division in Tulsa, has been named sales administrator. He joined Magcobar in 1950. **R. B. Hyde, Jr.,** has been named chief engineering consultant on the general sales manager's staff. With Magcobar since 1949, he served as district manager in Vernal, Utah, and Oklahoma City before transferring to Houston as an engineering consultant. **Jack G. Walker,** former export and industrial sales representative, has been appointed export sales manager. Since joining the company as a flying service engineer in 1949, Walker has served as drilling mud consultant for various companies in foreign operations. **R. E. Hinchliffe,** former district manager in the Lake Charles district, has been named manager of the company's Fort Worth division.

In Boiler Scale Removal and Prevention

SAND-BANUM

Pure Colloidal Concentrate

CASE HISTORY—Foaming and priming were exceedingly bad and frequent repairs to several engines due to water damage were necessary.

After trying upwards of 20 chemical compounds enough SAND-BANUM was supplied to permit a three months' test. The foaming and priming was stopped in 2 or 3 days and the scale began to disappear.

With the operation of SAND-BANUM, the washing periods were extended to 6 and later 8 weeks, REDUCING THE COST OF MAINTENANCE FROM $72.50 PER WEEK TO LESS THAN $30.00.

Send for details of our "Better Than a Money Back Guarantee" that you, too, may enjoy similar results.

Stocked by Leading Supply Houses

Gulf Coast District Representatives

WESTERN SAND-BANUM CO.

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AMERICAN SAND-BANUM CO., INC.

Established 1926

Meadow Brook National Bank Bldg.

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METALLIC PACKINGS
. . . utilizing a wide range of materials in the solving of normal or special operating problems — where Metallic Packings are needed.
France Makes Them!
Write for Complete Information
FRANCE PACKING COMPANY

9927 Bustleton Ave., Philadelphia 15, Pa.

Kenneth W. Robbins

A. W. Carroll

Scott F. Albright

A. A. White

Otis Pressure Control, Inc., has appointed **Kenneth W. Robbins** service manager to supervise and direct all service operations for the company. Robbins began with Otis in 1946 as a wire line helper. He was made consulting engineer in the Sales department in 1952 and was later named service office manager. **A. W. Carroll** has been appointed staff assistant in the Engineering department of Otis Engineering Corporation, manufacturing affiliate of Otis Pressure Control. Formerly liaison engineer, he began with Otis in 1940 as a helper in New Iberia, Brookhaven and Houma.

Scott F. Albright, of the Torrance, Calif., plant of **The National Supply Company,** has been appointed superintendent of industrial relations. He succeeds the late D. M. Sowle. Albright joined National Supply in 1950 as an industrial engineer.

A. A. White, appointed general service manager for **Unit Rig & Equipment Company,** has worked in the major oil fields of the U. S., Canada and Mexico. He has served Unit Rig as field engineer and as salesman. For three years prior to joining Unit Rig in 1948, he was a service engineer in the Gulf Coast area.

George L. Gore has been made district engineer and **Alfred Gionta,** district sales engineer, for **Dowell Incorporated** at Denver. Gore joined Dowell in 1949 and has served in various capacities at Great Bend, Kansas, and Tulsa. He was transferred to Denver in 1954 as petroleum engineer. Gionta joined Dowell in 1946 as a service engineer at Houston. Before his recent promotion, he was area engineer at Casper, Wyo.

American Cyanamid Company recently announced the appointment of **William A. Durbin** as manager of the Public Relations department. Durbin previously served as special agent for the Federal Bureau of Investigation, as director of public relations at St. Louis University and with the staff of Ivy Lee and T. J. Ross, public relations counsel. Since 1950 he has been director of public relations of Burroughs Corporation.

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PRESSURE & TEMPERATURE

CONTROLS

ENGINEERED FOR SEVERE OPERATING CONDITIONS

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Only Mercoid Offers

● *HERMETICALLY SEALED CONTACT*

Always dependable—whether it operates once per year or several times per minute. It remains operative at all times because dust, dirt, grease or moisture cannot contaminate the contacting elements. There can be no sticking or welding of the contact points.

● *OUTSIDE ADJUSTMENTS*

Independent outside adjustments are provided for setting both the cut-in and cut-out points. Differential may be widened as desired. No tools are required.

● *VISIBLE CALIBRATED DIAL*

No guesswork or calculations are required—the pointers indicate on an accurately calibrated dial, the exact operating pressures or temperature.

● *VISIBLE OPERATION*

You can tell at a glance whether switch circuit is on or off.

● *BOURDON TUBE OPERATED*

UNDERWRITERS' APPROVED

All operating ranges for Series DA-21, DA-35 and DA-55.

Available for general use, outdoor use or hazardous locations.

WRITE FOR BULLETIN 4B

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

"LIKE TO GET EVERY FOURTH WELL FREE?"

KEEP UP YOUR PRESENT DRILLING COMMITMENTS WITH LESS INVESTMENT PER WELL. USE A CASING HANGER.

BURNS CASING HANGERS

CASE HISTORY

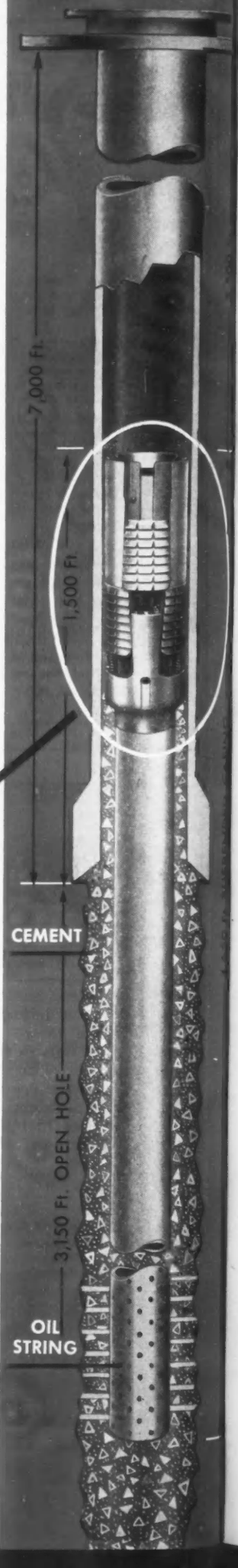
NO. 1875 BURMA OIL COMPANY

Protective Casing (8⅝") set at 7,000 ft. Oil string (5½") set at 10,150 ft. and hung on Burns Liner Hanger at 5,500 ft. thereby saving the cost of overlapping the 5,500 ft. of 5½" casing. Burns Hanger also eliminates hanging the weight of 5,500 ft. of oil string from the landing head. Cemented for 1,500 ft. below the Burns Hanger to protect oil string from corrosion in salt formation. Oil string is hung concentric with protective string for perfect cement job.

Burns Double Slip Hanger for Heavier, Longer Oil Strings. Utilizes Burns patented 100% contact safety slips.

A "rule of thumb" estimate in the oil fields indicates that savings with Burns Hangers by eliminating overlapped casing, labor, rigging time, etc. average approximately one-fourth the cost of completing a well. Your cement jobs come out perfectly and uniform in thickness. Get the complete story today. Check with us direct or consult a Burns distributor.

Burns Single Slip Hanger For Shorter Strings. Utilizes Burns patented 100% contact safety slips.



BURNS TOOL COMPANY

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Post Office Box 396
Farmington, New Mexico
Telephone Davis 5-3922

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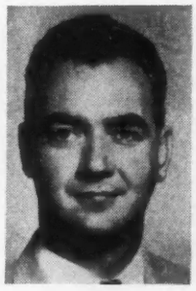
Edmonton, Alberta, Canada
Telephone 393-838

ALSO SOLD THROUGH SUPPLY HOUSES

Harry F. Vickers

Kenneth R. Herman

N. E. Edlefsen



A. B. Quinn

C. M. Reagle

James W. Reed

Vickers Incorporated recently elected **Harry F. Vickers** vice chairman of the board; **Kenneth R. Herman** president; and **N. E. Edlefsen** vice president for engineering. Vickers, founder of the company, also is president of Sperry-Rand Corporation of which Vickers is a subsidiary. Herman joined Vickers in 1931. A vice president of Sperry-Rand and a new member of the board of directors, he was a vice president and general manager of Vickers before his new appointment. Edlefsen, prior to joining Vickers, was associated with North American Aviation, Inc., as director of the electro-mechanical engineering department of the missile and control operation.

A. B. Quinn has been named president of **Harrisburg Sales & Service, Inc.**, by the company's board of directors. He replaces former President C. B. Caldwell, who recently resigned. Quinn formerly was associated with Stratoflex, Inc., as district manager at Los Angeles. Prior to that, he was sales engineer at Houston for Aeroquip Sales & Engineering, Inc.

C. M. Reagle has been named district manager of **Cooper-Bessemer Corporation's** New York domestic territory. Presently a vice president and director of Cooper-Bessemer, Reagle is also manager of marine sales. He joined the original Bessemer Gas Engine Company in 1922 and became a vice president and director in 1925. He was elected a vice president in 1929 when the original company merged with The Cooper Company to form the present Cooper-Bessemer Corporation. On the Pacific Coast, **James W. Reed**, vice president of Cooper-Bessemer, has been appointed Pacific Coast manager in charge of offices in Los Angeles, San Francisco and Seattle. **John Rogers**, who occupied this position for 15 years, has been appointed special representative and consultant. Reed, a vice president since 1947, has been New York district manager of compressor and stationary engine sales since 1940. He joined the company in 1922. Rogers joined Cooper-Bessemer in 1940 after 25 years of experience in the field of compressors and power engines.

Robert F. Smith, formerly at Hobbs, N. M., has been transferred to Houston as district sales engineer for **Lane-Wells Company** Gulf Coast division. **Kenneth D. Frick**, formerly of Odessa, has been transferred to Hobbs replacing Smith as district sales engineer there. In Lane-Wells Mid-Continent division, **J. K. Wagner** transferred to Casper, Wyo., as sub-district superintendent; **B. F. Lillard** transferred from Cody to Sterling, Colo., replacing Wagner and **John H. Tibbs** transferred from Newcastle, Wyo., to Cody, replacing Lillard as sub-district superintendent.

Joy Manufacturing Company has appointed **L. G. Felderman** sales manager, Rock Mechanization, with headquarters at the Franklin, Penn., plant. He formerly was manager, Sales Engineering, for all Franklin products. In his new position, Felderman will specialize on trackless mining products for hard rock and tunnel applications. Since 1945 he has done field work in all phases of mining and has helped develop mechanized mining of hard rock.

Clean Mud Saves Money, Trouble, Machinery and Time. A THOMPSON Separator Pays Off

Mud can become an expensive headache on drilling jobs. But smart operators and drillers everywhere are eliminating unnecessary loss of time, needless drilling expense, costly wear and tear on drilling equipment by using the Improved THOMPSON Rotating Shale Separator... equipped with the Sample Machine to provide specimens of formation cuttings.

A THOMPSON Separator effectively removes shale and abrasives from mud. Clean mud is fed back into the well. You're ahead... 'way ahead with a THOMPSON!

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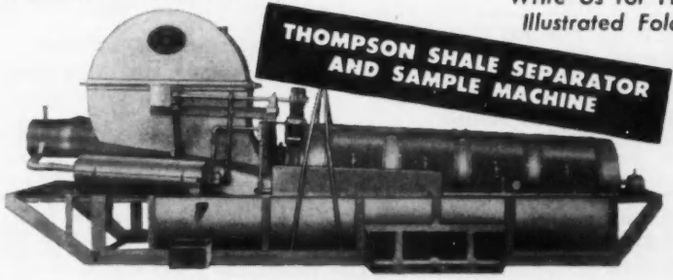


Manufacturers also of the famous THOMPSON Vibrating Shale Separator and Sample Machine.

THOMPSON TOOL CO.

IOWA PARK, TEXAS

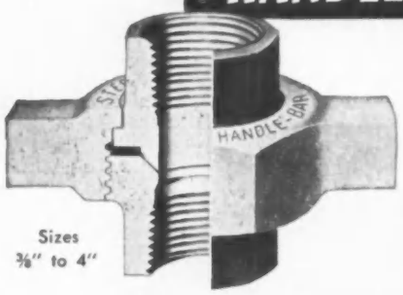
SOLD THROUGH SUPPLY STORES EVERYWHERE

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

100% contact safety slips.

ALSO SOLD THROUGH SUPPLY HOUSES

PRESSURES AND TEMPERATURES are SAFE in these "HANDLE-BAR" 4000 TEST



Sizes 3/8" to 4"

FORGED STEEL UNIONS

A skillfully engineered seat design provides the perfect seal for holding securely rated temperatures and pressures. Advanced manufacturing methods, rigidly controlled step by step to maintain the highest standard of quality, produce these accurately finished, rugged Handle-Bar Unions.

Quick and Easy to Make and Break because the nut threads are permanently lubricated with Udylite Cadmium. The Extra Heavy Nut provides the strength necessary to withstand rough handling and excessive abuse. So Great in Value . . . So Low in Cost.

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PROFIT FROM READING.... Here is information on books of Practical Job-value interest for men concerned with Drilling and Production

The knowledge gained through years of work and study by outstanding men in the field of exploration, drilling and production has been recorded for your reference and practical application.

- Composition and Properties of Oil Well Drilling Fluids — By WALTER F. ROGERS — price $10.00
- Practical Petroleum Engineer's Handbook — By ZABA & DOHERTY — price $11.00
- Rotary Drilling Handbook — By J. E. BRANTLEY — price $10.00
- Acidizing Handbook — By BENSON M. KINGSTON — price .... $ 3.50
- Basic Oil Geology — By W. W. PORTER III — price $4.00
- Practical Accounting for Oil Producers — By ROBERT M. PITCHER — price $9.50
- Petroleum Dictionary — By HOLLIS P. PORTER (Deceased) — price $6.00
- Oil Property Valuation — By PAUL PAINE — price $5.50

In ordering please make certain that your complete mailing address is included. Designate desired books by title and author. Attach your check or Money Order and shipment will be made promptly via prepaid Parcel Post.

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BOOK DEPARTMENT

THE GULF PUBLISHING COMPANY

P. O. Box 2608, Houston 1, Texas

C. F. Ludwig

N. H. Erwin

P. E. Tobin

Lenard D. Snyder

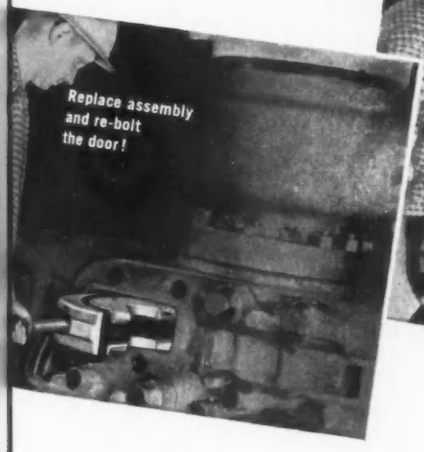
C. F. Ludwig has been named acting division manager of **Lane-Wells Company's** Pacific Coast division. With Lane-Wells 18 years, he has held positions in all three of the domestic divisions and Lane-Wells Canadian Company. He has been assistant manager of the Company's Pacific Coast division since 1951. **L. W. Denney,** formerly district sales engineer for Lane-Wells in Pampa, Texas, has been appointed sub-district superintendent there. **Edward C. Adcock,** radioactivity operator at Farmington, N. M., and **Ivan E. Wilkerson,** perforator operator at Perry, Okla., have been transferred to Pampa as district sales engineer trainees. **John L. Morton,** perforator operator at Casper, has been assigned to Newcastle, Wyo., as station superintendent for Lane-Wells. **Sam L. Conley,** formerly district sales engineer at Newcastle, has been transferred to Scottsbluff, Neb., as district sales engineer.

N. H. (Nate) Erwin has been promoted from Pacific division service manager to general service manager, Pacific and Mountain divisions of the **McCullough Tool Company.** Erwin has had 32 years experience in the oil industry and 18 years with McCullough, starting in 1923 as a roughneck at Maricopa Flats, Calif., and joining McCullough in 1937 at Los Angeles. He became Pacific division service manager in 1946.

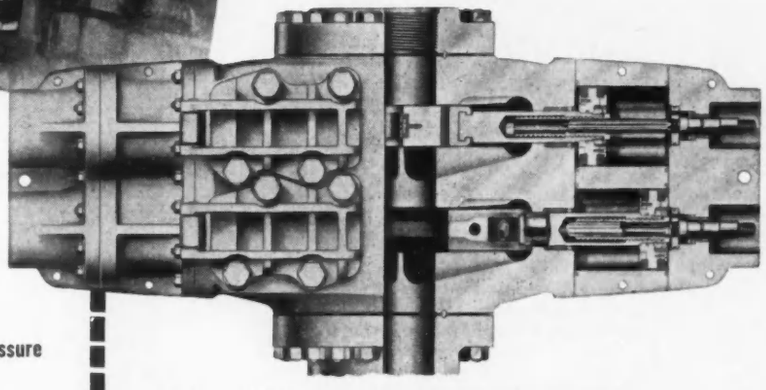
P. E. Tobin, appointed general sales manager of the Truck division of **The White Motor Company,** with headquarters in Cleveland, has been North Atlantic regional manager for White in New York City.

Joy Manufacturing Company has announced the appointment of **Lenard D. Snyder** as chief engineer, oil field products, with headquarters in the Dallas plant. Snyder, who has worked with oil field equipment since 1943, has been associated with George E. Failing Supply Company, Continental Oil Company and Drilling Accessory and Manufacturing Company.

ONLY SHAFFER gives this simplicity in changing rams!



Cutaway view of Shaffer Hydraulic Double Cellar Control Gate showing clean, simple design.



...and Many Other Cellar Control Gate Advantages!

Whether you prefer to call them "blowout preventers" or "cellar control gates," all pressure control equipment of this type has one common objective—to protect the well against pressure emergencies.

But there the similarity ends!

Because Shaffer Hydraulic Cellar Control Gates offer so many other far-reaching advantages—*in addition to unsurpassed pressure protection*—they have become the top choice among leading operators throughout the industry. For example, check simplicity of changing rams...

In Shaffer Hydraulic Cellar Control Gates there's no need to expand the gates endwise to permit changing the rams.

Nor is there need to allow extra space above the gate to permit lifting the rams out.

Nor on Double Gates is it necessary to dismantle the upper compartment to change rams in the lower compartment—or vice versa.

Each ram compartment has a convenient side-opening door. To change rams, simply unbolt and swing open the door—change rams—then close and bolt the door. Closing the door automatically aligns the rams within the gate. It's as simple as that!

And since each compartment of a Double Gate has its own set of doors, rams in either compartment can be changed with equal speed and simplicity.

But easy ram changes is only one of many extra advantages you get in Shaffer Hydraulic Control Gates. Other features are outlined at right. Before you buy *any* cellar control gates, why not get the complete Shaffer story from your nearest Shaffer representative? Or write direct!

Send for your free copy of the latest Shaffer Catalog.

Other Unique Shaffer Features

Compactness—All three dimensions—length, width, height—are unusually compact. For example, even in sizes as large as 13⅜" (12" Series 900), *total* height is only 30". No extra space is required above the gate for changing rams.

Choice of Designs—Shaffer provides a choice of *Single* or *Double* Gates... and a choice of *Rising* or *Non-Rising* Locking Shafts... in all sizes. Select the particular design *you* prefer for *your* requirements.

Trouble-Free Simplicity—Throughout, Shaffer Hydraulic Gates are designed for freedom from maintenance and operating problems. Rams travel on guide ribs high above the steeply-sloped, self-draining compartment bottoms. No detrimental mud or sand accumulations can interfere with free ram travel. Shaffer Hydraulic Gates are completely enclosed—no exposed moving parts to become damaged or corroded. Hydraulic cylinders are *directly behind* the rams for positive drive (there are no yokes or complicated secondary connections).

These and other advantages make Shaffer Hydraulic Gates top choice for maximum value in pressure protection!

See the Shaffer section of your Composite Catalog.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

32 years OF OIL TOOL LEADERSHIP

Houston Company Opens New Plant

Daniel Orifice Fitting Company recently completed and opened its new Houston plant which covers 15 acres on Katy Road. Sales and executive offices are housed in a modern office building that covers 6000 square feet. The fabricating shop has over 10,000 square feet and the machine shop covers 5000 square feet.

BOWEN *presents a tremendous advancement in Rotary Jar construction*

SEALED LUBRICATION
— practically eliminates wear
— greatly reduces servicing
— assures constant tripping tonnage

NOTHING PROTECTS METAL SURFACES LIKE AN *OIL BATH*

The tripping mechanisms in Sealed Type "I" BOWEN ROTARY JARS are identical with those in the earlier types of Bowen Jars that have performed successfully the world over under all types of conditions for many years. These new Jars differ in that they are filled with oil and sealed top and bottom against the ingress of well fluid. With this arrangement, the moving parts of SEALED TYPE "I" BOWEN ROTARY JARS work in a bath of oil.

SEALED TYPE "I" BOWEN ROTARY JARS are installed in fishing strings to enable the operator to strike heavy upward blows against an obstinate fish and knock it loose. They are also installed as safety devices in strings during testing, coring, reaming, drilling, side tracking and washing-over operations. Their presence insures the operator of the ability to knock the string loose should it stick.

Outstanding Advantages

SEALED TYPE "I" BOWEN ROTARY JARS are straight pull mechanical type Rotary Jars which provide greater efficiency in operations. They:

— Prevent accidental release of the fishing tools below the Jar
— Operate successfully under all conditions
— Deliver the same heavy upward blow regardless of the rate at which the string is elevated
— Feature oversize circulation holes which permit use of wire line tools and allow passage of large fluid volumes

Write for descriptive literature

SEALED TYPE "I" BOWEN ROTARY JARS

SR BOWEN CO

MAIN OFFICE AND PLANT:
11008 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL R. WITTICH, JR.

Borg-Warner-BJ Merger Would Mean Industry Expansion

The proposed merger of Borg-Warner Corporation and Byron Jackson Company will be accompanied by immediate and long range expansion in the electronics, petroleum and other industries. The purchase by Byron Jackson of 38½ acres in Santa Ana, Calif., for construction of a modern electronics plant, including one of the few private electronics testing laboratories on the Pacific Coast, has been announced by the company. Satisfactory and rapid progress on the development of a new sonic oil well drill has been revealed by Borg-Warner.

A proposal for the merger of the two concerns, already unanimously approved by the two boards of directors, was submitted to a vote of the stockholders of Byron Jackson August 23.

The new Byron Jackson electronics plant is to be erected in an area within the city limits of Santa Ana. The new plant will more than double present facilities of BJ's electronic division; the new electronics laboratory will be used for environmental testing of electronic devices and components.

Borg-Warner is one of the leading manufacturers of automotive, aircraft and agricultural implement parts and household appliances. Byron Jackson is a long established manufacturer of centrifugal pumps, oil field tools and services, electronic devices and nuclear power components.

Associated Oil Field Rentals Purchases George Rentals Firm

Associated Oil Field Rentals of Houston has purchased George Rental Service Company, expanding Associated's service to the oil and gas industry as well as enlarging its line of surface and sub-surface rental equipment.

The merger gives Associated a rental yard in Snyder, Texas, in addition to combining yards in Odessa and Houston, Texas, and in Harvey, La.

Wood George, former general manager of George Rental Service Company, has joined Associated as chairman of the operating committee. Other officials of Associated include H. J. Mosser, president; David C. Bintliff, vice president; Z. C. Ambrose, assistant president; and Ralph Neuhaus, vice president and general manager. The Associated firm is a subsidiary of Associated Oil & Gas Company with headquarters in Houston.

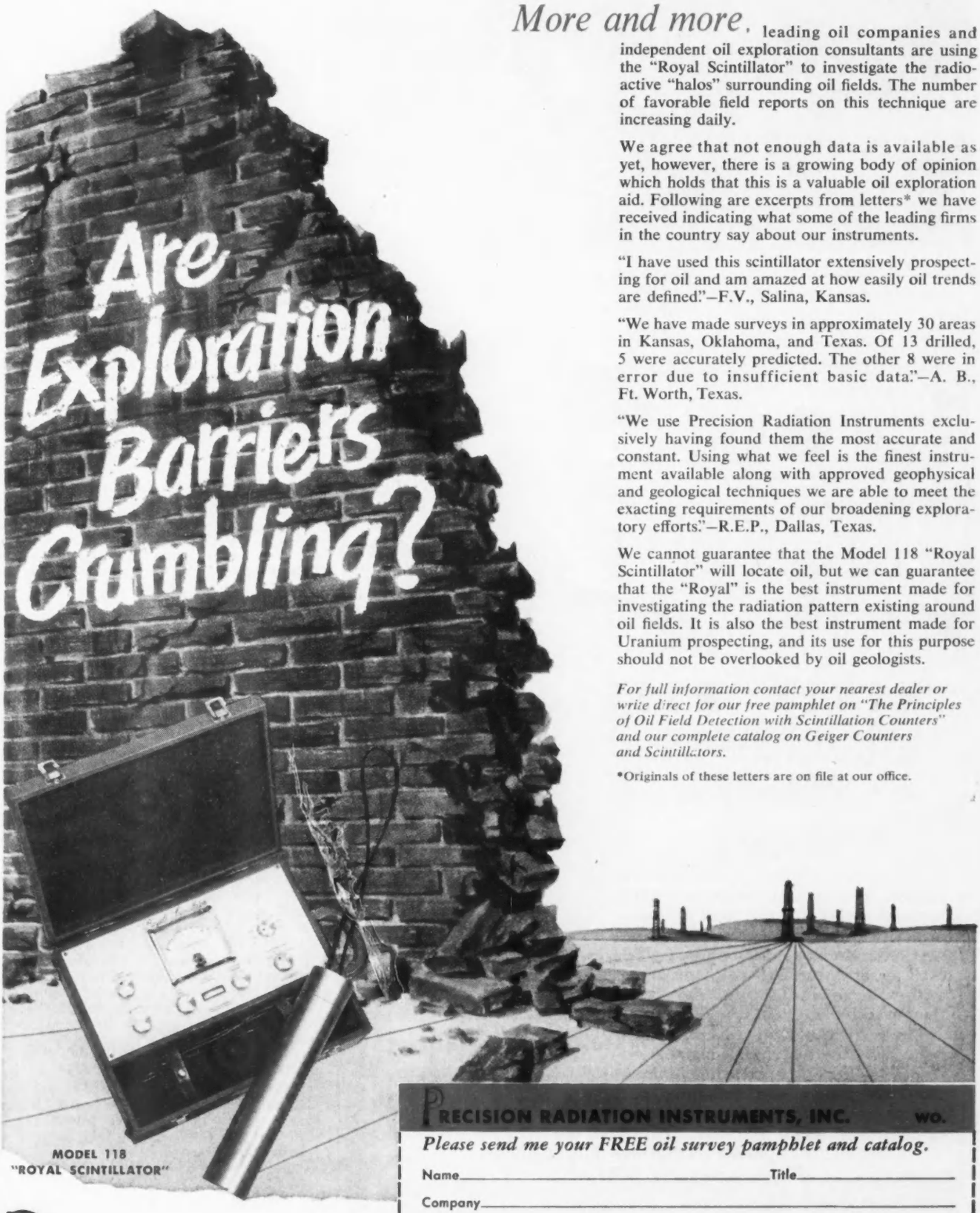
Jones & Laughlin Establishes Sales Office in New Orleans

The Jones & Laughlin Supply division has established a district sales office in the Hibernia Bank building in New Orleans. Clarence E. Rogers, the division's Louisiana Gulf Coast district sales manager, will maintain headquarters in the new office with Bill Wood, salesman for the New Orleans area.

The division operates 91 oil field supply stores and seven separate sales offices in 18 states and three Canadian provinces.

Shaffer Tool Works Builds New Shop in Oklahoma City

Shaffer Tool Works has started construction of a sales and service building and warehouse in Oklahoma City to be located on the Dallas-Oklahoma City Highwhy 77. Clay Fry has been named manager. The company manufactures high pressure oil drilling equipment.



MODEL 118
"ROYAL SCINTILLATOR"

More and more, leading oil companies and independent oil exploration consultants are using the "Royal Scintillator" to investigate the radioactive "halos" surrounding oil fields. The number of favorable field reports on this technique are increasing daily.

We agree that not enough data is available as yet, however, there is a growing body of opinion which holds that this is a valuable oil exploration aid. Following are excerpts from letters* we have received indicating what some of the leading firms in the country say about our instruments.

"I have used this scintillator extensively prospecting for oil and am amazed at how easily oil trends are defined."—F.V., Salina, Kansas.

"We have made surveys in approximately 30 areas in Kansas, Oklahoma, and Texas. Of 13 drilled, 5 were accurately predicted. The other 8 were in error due to insufficient basic data."—A. B., Ft. Worth, Texas.

"We use Precision Radiation Instruments exclusively having found them the most accurate and constant. Using what we feel is the finest instrument available along with approved geophysical and geological techniques we are able to meet the exacting requirements of our broadening exploratory efforts."—R.E.P., Dallas, Texas.

We cannot guarantee that the Model 118 "Royal Scintillator" will locate oil, but we can guarantee that the "Royal" is the best instrument made for investigating the radiation pattern existing around oil fields. It is also the best instrument made for Uranium prospecting, and its use for this purpose should not be overlooked by oil geologists.

For full information contact your nearest dealer or write direct for our free pamphlet on "The Principles of Oil Field Detection with Scintillation Counters" and our complete catalog on Geiger Counters and Scintillators.

*Originals of these letters are on file at our office.

PRECISION RADIATION INSTRUMENTS, INC. WO.

Please send me your FREE oil survey pamphlet and catalog.

Name_____ Title_____

Company_____

Address_____ City_____ State_____

PRECISION RADIATION INSTRUMENTS, INC.

4223 WO WEST JEFFERSON BOULEVARD, LOS ANGELES 16, CALIFORNIA

World's Largest Manufacturers of Radiation Instruments

Annual Sales Meeting

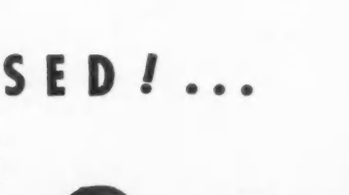
Attending the recent sales meeting of Don R. Hinderliter, Inc., manufacturer of tubing and casing heads for the oil industry, are (clockwise, beginning with near end of table) Don R. Hinderliter, president; C. J. Baeten, agent; Cy Miller, agent; J. O. Gravitt, agent; L. L. McColm, agent; Kenneth R. Taylor, production foreman; W. M. Ware, agent; Ward Settle, agent; R. R. Longnecker, agent, and Claude M. Hixson, plant superintendent. Not shown are agents Dick Franklin, P. T. Spence, T. B. Holland, Jim Smith and Val R. Wittich, export agent, New York City.

NEVER MISSED! ...

Annie Oakley, in her day, was noted as being the best marksman in the world. Rumors had it that she never missed.

It's a fact, not a rumor, you can never miss with an Enardo UNITANK© Flange. The assembly consists of a flanged body, retaining nut and gasket . . . the most efficient means of making removable tank connections. No bolt holes required. The body extends through the tank plate with the gasket between the body flange and plate.

The body is held in place by a left-hand retaining nut so that installation of pipe in the outer end tends to draw the tank flange and retaining nut tighter against the tank wall instead of loosening them.



Enardo UNITANK Flanges available in following pipe sizes: ½", ¾", 1", 1½", 2", 3", 4", 6".
Hillside Flange pipe sizes: 2", 3", 4".

Specify and order UNITANK© Flanges, they are A.P.I. approved.

ENARDO manufacturing company
BOX 1647 • TULSA, OKLAHOMA

Willis Expands in Houston To Serve Gulf Coast Area

To better serve the needs of the Gulf Coast area brought on by increased activity, Willis Oil Tool Company of Long Beach, Calif., has moved their Houston factory warehouse and offices into larger quarters at 5929 Waltrip Street. The move was prompted by the Willis Oil Tool Company expansion program in the Gulf Coast and Mid-Continent area. Robert F. Benda is district manager for Willis in Houston.

Fischer & Porter Company Sets El Paso Sales Office

Fischer & Porter Company has established a district sales office in El Paso, Texas. Charles Allen, formerly a field engineer in the firm's Houston office, has been named district manager. The El Paso sales territory comprises New Mexico and most of Texas west of and including San Angelo.

Camair Holds Inspection Tour At Galveston Airport Plant

Members of Galveston's Chamber of Commerce recently toured the Camair airplane manufacturing plant at the Galveston, Texas, Municipal Airport at the invitation of Gen. G. J. Weissenberger, USMC (retired), general manager, following sale and delivery of Camair's first production line 480, a twin-engine executive type plane.

At present, Camair is turning out one plane a week, with plans to double that rate in the near future. The plane, which is a remanufactured Navion plus many new parts and materials, attains a speed of 190 miles per hour and has a cruising range of 900 miles.

Camair occupies 11 buildings at the Galveston airport and employs 300 persons. The company is a subsidiary of the Cameron Iron Works, Inc. of Houston.

Nordberg Appoints Montana Firm Diesel, Gas Engine Distributor

Appointment of Tractor & Equipment Company, Sidney, Mont., as distributor and service headquarters for Nordberg Power Chief diesel and gas engines in eastern Montana and western North Dakota is announced by Nordberg Manufacturing Company.

With main sales and service headquarters in Sidney, Tractor & Equipment Company also has branch stores in Glasgow and Miles City, Mont. J. H. Harnish is president and general manager of the organization and R. A. Kaneski and J. C. Timmons manage the branch stores. A fully-equipped service department that can handle both field and shop work is part of the facilities of the Sidney firm.

K. K. Litman

F. E. Palmer

Baroid Announces Opening Of Four Area Offices

J. H. Beesley

New Orleans, Denver, Los Angeles and Tulsa have been designated as area headquarters for Baroid Division, National Lead Company, in an expansion move designed to meet the increasing demands for mud engineering service.

In New Orleans, K. K. Litman has been appointed manager of the Gulf Coast area which consists of Louisiana, Mississippi, Arkansas, Georgia, Alabama, Florida and North and South Carolina. With Baroid 13 years, he was formerly assistant Gulf Coast division manager. Harry C. Loehr, Jr., has been appointed area sales manager; Damon Banksston, sales representative of the Louisiana Gulf Coast area; and N. K. Tschirley, area engineer. The area is divided into five districts with superintendents directing and aiding the activities of the service engineers and related Baroid business.

The Denver office is area headquarters for the Rocky Mountains, an area composed of northwestern New Mexico, Utah, Colorado, northeastern Arizona, Wyoming, Montana, North and South Dakota. F. E. Palmer, appointed manager, has been with Baroid over 20 years. He previously had been sales representative in Denver. W. E. Gorham has been appointed assistant area manager, and C. Y. Vallance, sales representative with headquarters in Casper, Wyoming.

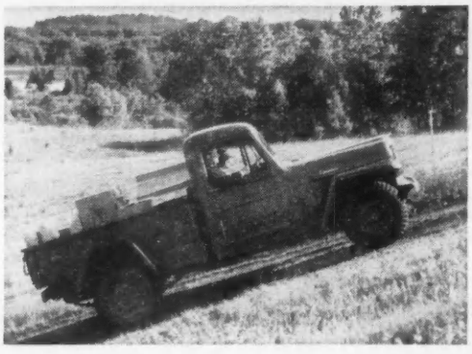
The Pacific Coast area headquarters have been established in Los Angeles, with E. L. Mohr, Jr., named manager. L. T. Weber, Jr., is assistant area manager; J. P. Byrne, sales representative; and Hubert Sanchez, manager of the Long Beach retail store.

Tulsa is now operational headquarters for the newly-designated Mid-Continent area which consists of Oklahoma, Nebraska, Kansas, north central and northeastern U. S. Jack H. Beesley, formerly division sales manager, has been named Mid-Continent manager. B. L. Boccella has been appointed assistant manager, R. D. Blaicher, sales representative; J. C. Luck, Jr., district sales representative with headquarters in Calgary, Alberta, Canada; and Bruce Emerson, area engineer.

Wolverine Tube Opens New General Sales Offices

Wolverine Tube, division of Calumet & Hecla, Inc., has announced the opening of new general sales offices in the Guardian building, Detroit. Wolverine manufactures quality-controlled tubing and extruded aluminum shapes.

Automatic Free-wheeling 2-wheel drive for 4 W. Ds.



WARN *Automatic* HUBS

automatically engage or disengage the front wheels from the power train as you shift into 4-wheel drive, or back to 2-wheel drive.

Go farther, faster, easier—roads or no roads!

No matter where you drive, whenever you use 2-wheel drive it's fast, economical *free-wheeling* 2-wheel drive with Warn *Automatics*. For 4-wheel drive, shift! You have it, *plus something new*—torque-free high speed driving in 4 w. d.! Warn Hubs stop drag, save gas, gears, tires in 2 w. d.—make 4 w. ds. peppy as pick-ups! Install them now—use your 4 w. d. for any purpose! Automatic and Locking models for Willys at Willys Dealers only. For other 4 W. Ds. at dealers or write:

PATENTED

WARN SELECTIVE DRIVE HUBS

Warn Mfg. Co. Riverton Box 6064-WO., Seattle 88, Washington.

RADIOACTIVE SERVICE TRACER

RESEARCH BUILDS BUSINESS

RADIOACTIVE TRACER SERVICE

Accurately measure underground movement of oil, gas, or water in storage, recycling, pressure maintenance, and secondary recovery operations.

Two component tracers, separately measured.

CONSULTING ENGINEERING

Years of experience and know how.

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Creative skill, modern facilities applied to the problems of industry.

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ELECTRO CHEM

U. S. Firm Plans to Establish Full-Time European School

The Minneapolis-Honeywell Regulator Company recently announced plans for the establishment in England of a technical training school to groom engineers and other technical personnel in the use of automatic control equipment used broadly in the U. S. Classes for the first year will comprise M-H personnel from Great Britain, Holland, Switzerland, Belgium, Sweden and Germany. Later plans call for customer students from Great Britain and western European industrial firms to attend the school.

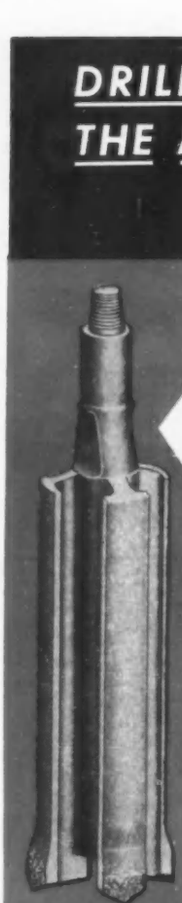
This is believed to be the first full-time training school set up abroad by an American manufacturer. The industrial control devices to be studied cover a wide variety of automatic recording, measuring and controlling instruments which are typical of the automatic pattern that is growing rapidly in the U. S.

The new training school, to be established in Perivale, England, will be a one-level building with fully equipped classrooms and laboratories. Tuition will be free and the courses will run about ten weeks. In some cases they will extend to 14 weeks, or as long as an ordinary college quarter. Final exams and a diploma will follow.

Director of the school will be Harry Horton, an Englishman, a member of the firm's subsidiary in Great Britain, Honeywell-Brown Ltd. Horton, whose M-H background is primarily in sales and service, is a graduate electrical engineer.

DRILL LARGE DIAMETER HOLES THE MODERN WAY... WITH

SPANG FABRICATED STAR BITS



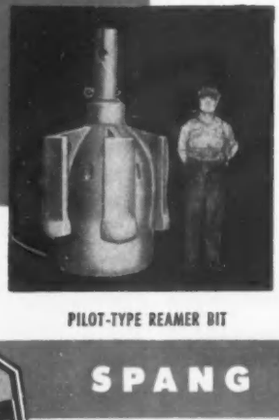
Progressive Operators Everywhere Are Discovering This Modern, Better Way Of Drilling Large Diameter Holes.

SPANG FABRICATED STAR BITS replace the conventional, old-style spudding bit and the big hole paddle-type bit. They are made in large diameters for drilling hard formations, and can be dressed, ready for drilling, by hard surfacing quickly and economically, thereby saving the time consumed heating and ramming. Made in a variety of diameters, lengths and weights, with any size joint desired, SPANG Fabricated STAR BITS are your assurance of profitable **big hole** drilling.

For Extremely Large Diameter Holes
SPANG PILOT-TYPE REAMER BITS ARE RECOMMENDED

Field performance has amply proved these bits to be the driller's answer to **large hole** problems. They are made special, to your specifications and design, in any diameter; size and weight limited only by the handling capacity of conventional drilling rigs. They can be furnished to run on drilling stem or with integral rope socket top.

For detailed information on SPANG Fabricated STAR BITS and SPANG PILOT-TYPE REAMER BITS for big hole drilling, plus 52 page CATALOG, consult your nearest SPANG DEALER or write direct to



PILOT-TYPE REAMER BIT

The HIGHER STANDARD

SPANG & COMPANY

DEPT. O-6 BUTLER, PENNSYLVANIA

For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Water Wells, Prospect Drilling and Shot Blast Holes.

MacGuire Company to Represent Hammel-Dahl in Carolina, Virginia

The Hammel-Dahl Company has appointed MacGuire Instrument Company their new sales and service representative. The new organization will offer complete sales and service facilities of Hammel-Dahl engineering and products in South Carolina, North Carolina and part of Virginia.

W. J. MacGuire

William J. MacGuire is in charge of the company's sales and service. For the past five years he has been with E. I. du Pont de Nemours in instrument consulting and design.

Schlumberger Names Baker Head of New Illinois Station

Schlumberger Well Surveying Corporation has opened a new location at Harrisburg, Ill. to take care of increased activity in the Illinois Basin due to the recent discovery of the Eldorado field.

Willis P. Baker is in charge of the new station. Joseph A. McGuire is engineer. Both logging and gun perforating services will be available from Harrisburg.

Western Company Opens Oklahoma Sales Office

A regional sales office to serve the petroleum industry of central Oklahoma has been established in Oklahoma City by The Western Company, oil field servicing organization with headquarters in Midland, Texas.

W. W. Wilson

W. W. Wilson is regional sales manager in charge of the new office. He was transferred from Wichita Falls. R. N. Brammer, sales engineer, will work with Wilson.

The Oklahoma City office and staff will represent Western on all four of its services, radioactivity logging, jet perforating, fracturing and acidizing.

Texas Instruments Establishing Los Angeles District Office

Texas Instruments Incorporated is opening a Los Angeles sales office as the first step in establishing marketing headquarters throughout the U. S. The office will be headquarters for the Western district and is the first of several offices scheduled to be opened this year.

The firm previously marketed its products and services mainly with the aid of sales representatives based at company headquarters in Dallas and with only a few specialized representatives in the larger cities. The new district offices will be staffed with representatives of Texas Instruments' manufacturing divisions.

Western district office personnel will include William J. Brugman, Semiconductor Products division, W. M. Montgomery, Jr., Components division, and Rex Welch, Apparatus division.

Washington Firm to Represent Cleaver-Brooks in Northwest

The Cleaver-Brooks Company announces the appointment of the Barrett & Yost Company as manufacturers' representative for the sale of Cleaver-Brooks boilers and equipment.

Located in Seattle, Wash., its territory will include the state of Washington excluding the counties of Clark, Cowlitz, Klickitat, Skamania and Wahkiakum. Also included as part of its territory are the counties of Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez Perce and Shoshone in the state of Idaho.

Cleaver-Brooks Company manufactures equipment for the generation and utilization of heat. Among its products are oil, gas and combination oil/gas fired stationary boilers, mobile steam boilers, distillation equipment, evaporators and industrial oil and gas burners.

Foxboro Company Signs New Japanese Associate

Foxboro instrumentation for Asiatic industries shortly will be available through the Yokogawa Electric Works, Ltd., Tokoyo, Japan. The Japanese firm will manufacture and sell the full Foxboro line, as well as its own electrical strip chart instruments.

Foxboro-YEW products will be identical in design, appearance and performance to those manufactured at Foxboro, Mass., and at associated firms in London and Montreal.

Rolls-Royce to Manufacture Twin Disc Torque Converters

Rolls-Royce, Limited, of England, has signed an engineering license agreement with the Twin Disc Clutch Company under which they will manufacture in England torque converters of Twin Disc design.

Torque converters made under this agreement will be used with Rolls-Royce industrial oil and gasoline engines powering crawler tractors, rail cars and switching locomotives, off-highway trucks and similar heavy-duty equipment. The agreement also provides for interchange of technical information relating to design, manufacture and application of torque converters.

Lane-Wells Opens Branches In Gulf Coast, Nebraska

Three branches have been opened by Lane-Wells Company in the Gulf Coast division, bringing the division total to fifty. A sales office was established at El Campo, Texas, with B. A. Jones assigned district sales engineer. A new truck station, established on Highway 80 in Sweetwater, Texas, is staffed by personnel from the Winters, Texas, base which has been closed. J. R. Ross is station superintendent. Burt R. Brashier has been transferred from Magnolia, Ark., to El Dorado, Ark., as operator in charge of the second new truck station, opened at 1618 Northwest Avenue in El Dorado.

In Nebraska, the first Lane-Wells branch in the state has been opened in Kimball. The new branch is equipped to provide perforating service and well logging service on a 24-hour a day basis. Harold Summers, veteran in oil field service, is in charge of the new station, also staffed by Harold Karger.

WORLD OIL'S Trading Post CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted ads,** 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 17th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

HELP WANTED

■ Manufacturer's representative wanted for new patented Dual-Matic Valve and Choke Assembly. Territories open—West Texas, Rocky Mountains, California, Canada and Louisiana. Send complete information to Texas Tool and Machine Company, P. O. Box 15264, Houston 20, Texas.

GEOLOGIST of outstanding ability for strong independent oil company establishing district headquarters in New Orleans, La., for operations in Coastal Louisiana. Must have had at least seven years diversified subsurface experience in Louisiana and Upper Texas Gulf Coast and be able to evaluate a subsurface or seismograph prospect. Bachelor degree minimum requirement. This is a position that requires initiative and enthusiasm for oil finding. Permanence of employment and opportunity for advancement are assured if expanded operation is successful. Salary commensurate with qualifications. Applicant should give complete background information, references, and salary expected. Replies strictly confidential. P. O. Box 432, Corpus Christi, Texas.

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POSITIONS WANTED

■ Graduate Geologist 24, one year experience with Major Service Company wants permanent geological work with oil company. Box 71-W, WORLD OIL, Houston, Texas.

BUSINESS SERVICE

■ Delaware Corporations formed and serviced. Inquire without obligation. American Guaranty & Trust Company, 910 West Street, Wilmington, Delaware.

NOTICE

■ Anyone knowing the whereabouts of Earl Clifton Nance, an oil field worker, please contact Box 69-W c/o World Oil, Houston, Texas.

■ ANTI-TRUST CASES SETTLED. After extended negotiation, upon consent of the parties and without trial of the case, upon April 7, 1955, a final judgment was entered in the case of United States of America vs. Magcobar, Inc., Dresser Industries, Inc., Clarence J. Coberly, Dresser Equipment Company and Kobe Inc., Civil No. 13460-BH. Under the terms of this judgment Kobe, Inc., is required to grant licenses under its patents relating to hydraulic oil well pumps on a reasonable royalty basis. A list of such patents and a copy of such final judgment will be furnished upon request to **Kobe, Inc.,** 3040 East Slauson Avenue, Huntington Park, California.

BUSINESS OPPORTUNITIES

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

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SQUEAKS from the BULLWHEEL

Opportunist

The village blacksmith presided at a small town concert, and, as a compliment to him, the chorus sang "The Village Blacksmith" to enthusiastic applause. As they got up to respond to the encore, the smith whispered to the leader, "When you sing that again, would you mind putting in a verse about me repairing bicycles?"

Local Politician

Voter: "Why, I wouldn't vote for you if you were St. Peter himself."

Candidate: "If I were St. Peter, you couldn't vote for me—you wouldn't be in my district."

Roger, and Out

"What's that ugly insignia on the side of the bomber?"

"Sh-h-h! That's the commanding officer looking out of the porthole."

Black Day

Having noticed that his Scottish guide usually went bareheaded in all sorts of weather, the London sportsman made him a gift of a fur cap, the kind with heavy ear flaps for extra warmth. On his next visit to the hunting lodge, in the middle of winter, he asked the old Scot how he liked the cap.

"I hae no worn it since the accident," was the gloomy reply.

"What accident?" his benefactor asked.

"Jock MacLeod offered to buy me a drink," sighed the guide, "and I didna hear him."

Dare You!

Two bitter rivals were playing in the finals of their country club golf championship. One of them talked constantly as they played their match, much to the annoyance of his opponent.

Finally, the latter burst out: "Look here, Smithers, if you don't stop your infernal chatter, I'm going to hit you over the head with my mashie."

"Go ahead," replied Smithers, "but if you do, it'll cost you a stroke."

Real Concern

"Why is Mr. Knight pacing up and down on his front porch?"

"He's awfully worried about his wife."

"Is that so? What's she got?"

"The car."

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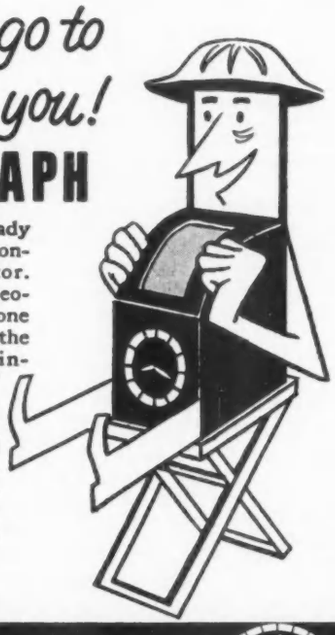

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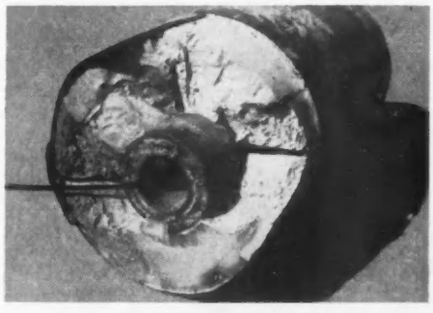
Two String Penetration by Glass Jets Brings in Good Well

McCullough Super Casing Glass Jet Perforators with Steel Strip Carriers were used to perforate 232 holes through 5½" O.D. 17 lb. casing cemented in 11" hole in an interval from 8160' to 8218'.

After perforating, the formation broke down at 3400 lbs. and took acid at 2000 lbs. Well came in without swabbing and flowed for 13 hours with tubing pressure at 750 lbs.

Operator reacidized with 6000 gallons. Formation took the acid at 1800 lbs. After the well cleaned up, production was turned into the tanks and made 550 barrels of clean oil on a 24 hour test through an 18/64 bean with tubing pressure of 900 lbs.

The McCullough Glass Jet Perforator with Steel Strip Carrier is the best jet perforating process available. It has more power; will obtain deeper penetration



Three strings of casing, 5", 7" and 8⅝", cemented in steel drum and perforated by (left to right) McCullough Super Formation, Standard Casing and Super Casing Glass Jets. Standard Casing Glass Jet penetrated all three strings of casing and 7" into cement, while the other types penetrated through everything, including the outside drum.

through multiple strings of casing, extra thick cement sheaths and far into hard and extra hard formations. Holes are larger, more uniformly round and are straight sided almost the entire depth of penetration. Slugs or carrots are eliminated. These advantages mean more exposed formation area, greater production, more oil!

Single trip, multiple zone perforating jobs are commonplace. Strip Carriers may be loaded full length or sections may be left blank to leave unperforated areas in the casing. Result: Less rig time; greater efficiency; more economy!

Glass Jets Save Rig Time, Perforate 11 Zones in Two Runs

Only Three Hours Required to Shoot 618 McCullough Glass Jets in 169 Feet of Split Zones

McCullough 3¾" Standard Casing Glass Jet Perforators with Steel Strip Carriers turned in a record time-saving performance in a West Central Texas oil well, according to a recent field report.

The well had first been logged to 6347' by the McCullough Radiation Well Logger obtaining Gamma Ray, Neutron and casing collar log. 11 thin zones were selected for perforating and for accurate measurements the zones were shot by the combination radiation-collar log depths.

618 Glass Jets, six per foot, were fired through 5½" O.D. 17 lb. cemented casing in the 11 selected zones between 6118' and 6290'. Only two runs in the hole were made.

On the first run an 87' Steel Strip Carrier was used. 294 Glass Jets were fired in five zones varying in thickness from 6' to 16'. On the second run an 82' Steel Strip Carrier loaded with 324 Glass Jets perforated six zones from 3' to 24' in thickness. In both runs the Steel Strip Carriers were blanked off between the different zones. After firing both Steel Strip Carriers were recovered intact.

Only three hours were required to complete the job, including rigging up and tearing down time.

Rig time is expensive and when a perforating job can be completed with an average of better than 200 shots per hour, the saving to the operator is considerable.

One of the most important advantages of completing a well with McCullough services is illustrated by this job. That is the extreme accuracy with which the McCullough Radiation Well Logger picked and defined the boundaries of the 11 thin zones. Thus, enabling "pin point" perforating exactly where desired without wasted time and in only two runs in the hole.

AVERAGE PENETRATION OBTAINED BY McCULLOUGH GLASS JET PERFORATORS

TYPE GUN	IN SOLID STEEL TARGET	IN ONE STRING AND CEMENT TARGET	IN TWO STRING AND CEMENT TARGET	IN THREE STRING AND CEMENT TARGET
Standard Casing Glass Jet	3¾"	7⅛"	6 13/16"	6⅛"
Super Casing Glass Jet	4¾"	8½"	8⅛"	7 5/16"
Super Formation Glass Jet	5¾"	9¾"	9 3/16"	8¼"

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"I think it's a lotta baloney to pipe the toolpusher aboard the barge cause he's an old Navy man . . ."

Don't Worry

The hellfire and brimstone preacher had reached his climax. "On that dreadful Judgment Day," he shouted, "there will be weeping and wailing and gnashing of teeth."

An old woman in the back stood up.

"Reverend," she said, "I ain't got no teeth."

"Madam," he yelled back, "teeth will be provided."

Well Planned

"I know what's passing in your mind," said the maiden. "I know why you are calling here night after night, appropriating my time to yourself and keeping other nice young men away. You want me to marry you, don't you?"

"I—I do?" gasped the astonished young man.

"I thought so," smiled the girl. "Very well, I will."

Correction

A man telephoned the police to report that thieves had been at work on his car.

"They've stolen the steering wheel, the brake pedal, the accelerator, the clutch pedal and the dashboard," he complained.

A police officer said he would investigate. Then the telephone rang within a short time.

"Don't bother," said the same voice somewhat inebriated. "I got into the back seat by mistake."

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- **Kinked Gauge Lines**
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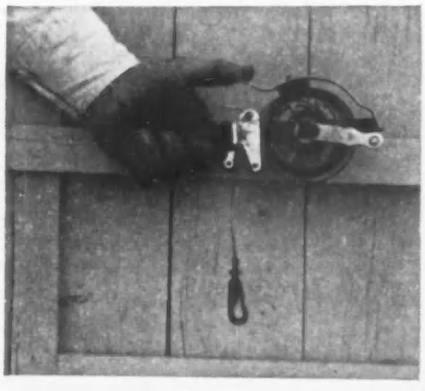

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GOTKOOL Water Can—made in 1½, 2, 3, 5, 10, 15, and 20-gallon sizes without faucets. Extended or recessed flush-mounted faucets available at slight additional cost. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

GOTKOOL Water Cooler—made in 2, 3, 5, 8, 10, 15, and 20-gallon sizes with extended or recessed flush-mounted faucet optional. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

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"It don't look safe to me either, but this Italian engineer says there's one in his home town that has been standing for centuries!"

Proper Instruction

Her: "Say, what are those marks on your nose?"

Him: "They were made by my glasses."

Her: "You should learn to tilt your head back, it pours easier."

Homespun Philosophy

It's easy to call a spade a spade until you hit your foot with one.

Teed Off

First Golfer: The traps on this course are very annoying, aren't they?

Second Golfer: They sure are. Would you mind closing yours?

Good Recommendation

Sign in pet shop window: "Healthy kitten wants good home. Honest, loyal, sober, will do light mousework."

Modern Generation

It was an eight-year-old's first trip to a movie and he didn't think much of the film. "Daddy," yawned the kid, "change the channel."

Takes Time

Talkative barber: "Your hair seems to be turning gray."

Impatient customer: "I'm not surprised. Can't you work a little faster, and do less talking?"

Simple Enough

A lady opened her refrigerator door, and a rabbit was sitting there. She said, "Well. What are you doing here?"

The rabbit said, "This is a Westinghouse, isn't it?"

"Yes," said the lady.

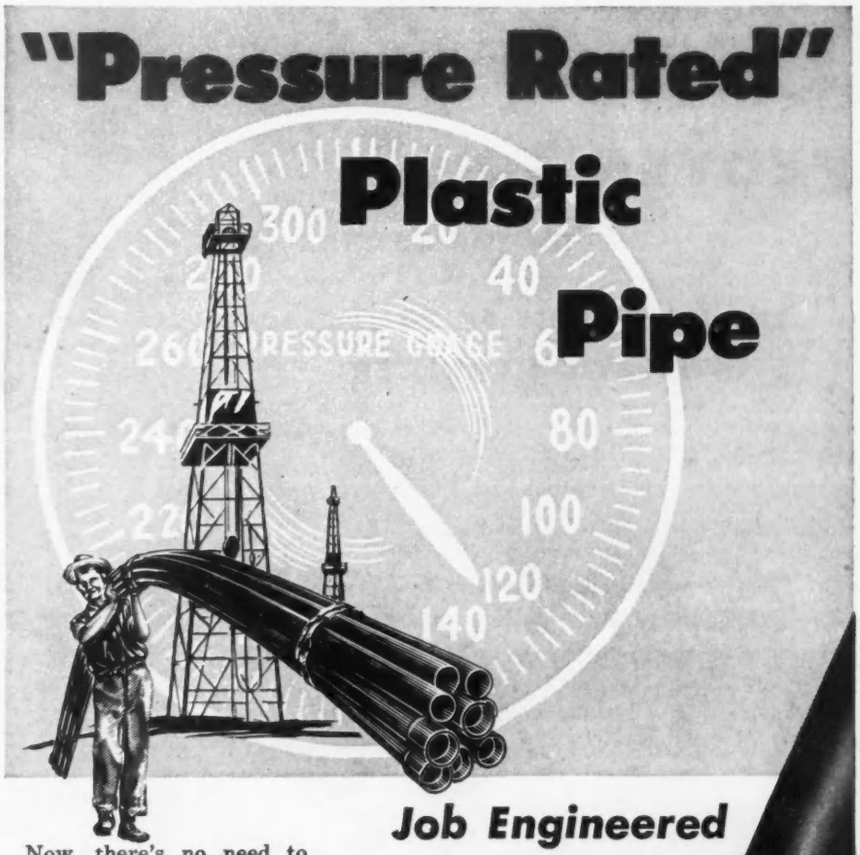
Then the little rabbit said, "Well, I'm westin'."

New Outlook

On the day John learned of the birth of his first grandchild, a friend inquired how it felt to be a grandfather.

"It's good news, of course," John replied. "But I'll have to get used to the idea of being married to a grandmother."

"Pressure Rated" Plastic Pipe



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For more details, write for Bulletin 128 D

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New Books, Maps and Movies

PETROLEUM REVIEW, ECTOR COUNTY, TEXAS, Phifer Petroleum Publications, P. O. Box 20,024, Houston 25. $10.

This new oil and gas reference book is the third in a series covering oil and gas production in West Texas counties. Sixty-seven fields have been discovered in Ector County since 1926 and have produced over one-half billion barrels of oil. The discovery well and pertinent information, location of the field, rules and regulations, number of producing wells at the end of each year and production record are some of the highlights in the development of each field included in the book. Illustrations include a county map with the fields in color, a geological chart, 21 logs of discovery wells and 20 structure maps presented by operators at hearings before the Railroad Commission of Texas.

Information contained in the book was compiled by Robert L. Phifer from hearings on the fields by the Railroad Commission. Previous books were on Andrews and Gaines counties.

•

KNOLLYS AREA OF SASKATCHEWAN, Surveys Branch, Department of Natural Resources, Administration Building, Regina, Saskatchewan, Canada. 25 cents each for respective East or West halves.

The Knollys area, situated about five miles west of Eastend, Saskatchewan, is now represented by a map in scale of one to 50,000, or approximately 1¼-inches to the mile. In addition to roads, trails, railways, water features and dams, oil wells are shown. Farm homes, township and sections, elevations and bench marks are shown. Changes in elevation of terrain is represented by contour lines at 25 foot vertical intervals.

The West half Knollys sheet represents a rectangular area 15 miles south and one mile north of Knollys and 10 miles east and west therefrom. The East half shows about the same area, traversed by the Frenchman river.

•

GEOLOGIC AND STRUCTURE MAP OF THE SUSSEX AND MEADOW CREEK OIL FIELDS AND VICINITY, JOHNSON AND NATRONA COUNTIES, WYOMING, U. S. Geological Survey, Distribution Section, Denver Federal Center. 50 cents.

The map shows distribution of upper Cretaceous Steele shale, Mesaverde formation, Lewis shale, Lance formation, Tertiary Fort Union and Wasatch formations in the area. Stratigrahy of rocks ranging from Tertiary to Pre-Cambrian are shown by a columnar rock section. Well status as of January, 1954, also is included. The map was published as a result of a survey made to aid administration of the oil and gas provision of the federal mineral leasing law.

•

SPECIFICATION FOR OIL WELL CEMENTS, Division of Production, American Petroleum Institute, Dallas.

Publication of the second edition of Standard LOA marks the first official publication of an API specification covering oil field materials, in distinction to equipment.

The new standard establishes three regular, three retarded and five sulfate-resistant classes of cement. Physical and chemical requirements are prescribed for each class. Application by manufacturers for right to apply the API monogram is provided for by the same process applying to equipment standards.

The standard is the result of intensive committee effort over four years, including close attention to the development of a recommended practice for testing cements. Testing procedure finally arrived at is covered in a separate publication, API RP 10B, and governs the sampling and testing provision of Standard 10A.

SAMPLE DESCRIPTIONS AND CORRELATIONS FOR SELECTED WELLS IN NORTHERN ARKANSAS, Arkansas Resources and Development Commission, Division of Geology, State Capitol Building, Little Rock. $2.

Compiled cooperatively by the Arkansas Resources and Development Commission and the U. S. Geological Survey, the book presents detailed descriptive logs prepared by microscopic examination of samples from wells drilled in 22 counties in northern Arkansas. Stratigraphic investigations for the book were begun in 1949 when search for oil and gas started.

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Box 2496 Tulsa, Oklahoma

What's New In Equipment

Drilling • Production • Exploration

Crawler Tractor

Introduction of a 90-horsepower crawler type tractor is announced by Hanomag of Hannover. Identified as the K90E, this new tractor is available with factory mounted angledozer as illustrated or with standard bulldozer or overhead loader equipment.

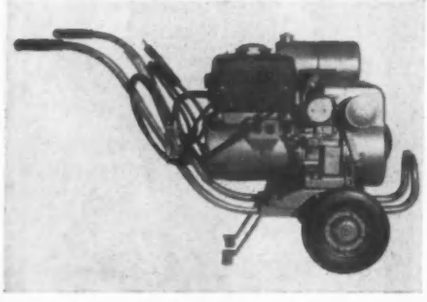
For more data circle **No. E1** on Readers' Service Card, last page this issue.

Generator-Welder

A new, low-cost, portable A.C. generator-welder combination weighing 250 pounds has been announced by Royal Arc Industries.

Designed as a portable source of AC power, the unit combines the new air-cooled Onan, 2500 watt, 115 volt, 60 cycle, AC electric generating plant with the Royal Arc 150AJ transformer-type welder to become a versatile generator-welder package.

As separate units, the generator or welder may be operated independently of each other. The welder may be disconnected, and the generator then becomes a portable AC power plant. The welder may be lifted free from the assembly and



plugged into any 110 or 220 volt, single-phase, AC source for repair and maintenance work of all kinds.

This self-contained generator-welder combination is available mounted on a light, two-wheel dolly or a welded tubular steel carrying frame.

For more data circle **No. E2** on Readers' Service Card, last page this issue.

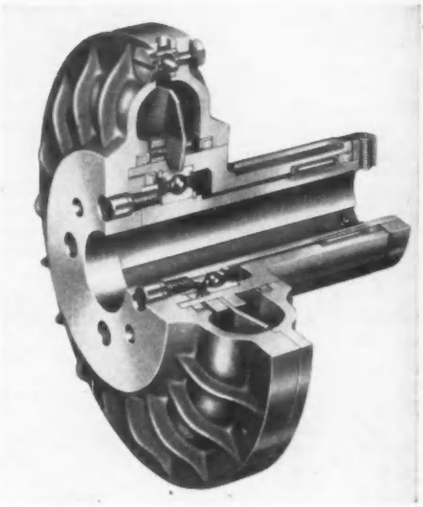
Power Transmission

A new development in industrial power transmission, Flexidyne, a dry fluid drive, has been announced by the Dodge Manufacturing Corporation as the latest addition to its line. Based upon a new principle, Flexidyne easily handles difficult starting and reversing problems and gives a new kind of protection against shock and overloads. At normal operating speeds it does not slip; in case of an overload, it is slippage which gives protection.

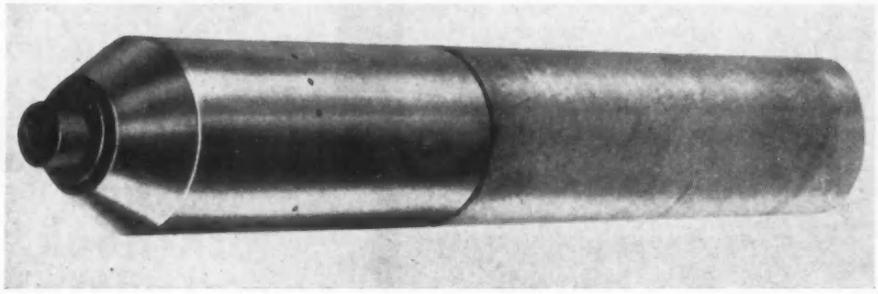
It has been designed for industrial drives involving heavy inertia and shock loads on such equipment as compressors, centrifuges, conveyors, crushers and machines used in oil fields.

The Flexidyne Drive is made up of a housing, inside of which a rotor is free to turn concentrically. Between the two are fine particles of spherical steel shot which act very much like a fluid. It is the flow charge which transmits power from the housing to the rotor. This flow charge is easy to seal in, has a high density and can stand relatively high temperatures.

Flexidyne permits use of smaller, cheaper motors and controls, with greatly reduced current demands and improved power factor. Its smoother starts and gentler overload protection avoid breakage and reduce maintenance on drives, gears, bearings and driven machinery.



For more data circle **No. E3** on Readers' Service Card, last page this issue.



Chemical Pipe Cutter

McCullough Tool Company and Pennsylvania Salt Manufacturing Company have collaborated in the design and development of a new chemical pipe cutter for oil well service. The specific collaborators were McCullough Tool Company's W. G. (Bill) Sweetman, director of Explosive Research, a leading explosive expert known for his work in development of jet tools and wire line devices for cutting and perforating operation in oil wells; and Pennsalt's research team of John Gall, Henry Miller and Fred Loomis, members of the organization which developed one of the earliest successful flourine cells and made the first shipments of anhydrous hydrogen flouride and elemental flourine.

Sweetman, to overcome limitations of mechanical, gun and explosive jet tool devices for use in the narrow confines of a well bore, conceived the method of combining the reactive properties of fluorine and its more reactive compounds with the effect produced by application of pressures. He found he could greatly accelerate the rate of release of maximum amounts of energy by the chemical compounds and concentrate it effectively at the desired points on the surfaces to be attacked. Pennsalt aided him in selection of the best compounds and with the problems of packaging, loading, storing and handling the highly reactive compounds involved.

The chemical is contained in a heavy-walled cylinder equipped with pressurizing chamber and a firing head with appropriately spaced orifices. The assembly is lowered into the oil well on a wire line, is positioned accurately and held in place against powerful thrusts by specially designed latches. Upon electrical impulse, the propellent is ignited causing the latches to set and purging the chemical chamber. The chemical is ejected under enormous pressure against the inner pipe wall, which it penetrates in a fraction of a second. This is a simple chemical reaction of flourine and ferrite causing oxidation of the metal. The tool makes a clean cut with no flaring. It also perforates a smooth, burrless hole.

(This item supplements McCullough Tool Company data on Pages 3093-3132 of the Composite Catalog, 20th Edition.)

For more data circle **No. E4** on Readers' Service Card, last page this issue.

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.

Guiberson Type GW Packer Cup

SEALS AUTOMATICALLY

HOLDS HIGH PRESSURES

Most versatile cup in the oil fields today, the Guiberson GW Packer Cup is a cup of a thousand uses. It provides an automatic sealing element adaptable to a multitude of tools — well testing and cementing tools, sand pump pistons, perforation cleaners, production packers, line packers, junk pushers, casing testers, blowout preventer testers and countless others. The GW cup *seals automatically* the moment pressure is applied — the greater the pressure, the tighter the seal. A directional packing element, the GW packs off and holds pressure on the side the lip is pointed. Lip readily passes fluid in opposite direction, acting as a casing check valve. The GW Packer Cup is molded of special oil and gas resistant compound. Its strong, flexible lip of oversize diameter gives instantaneous and positive sealing at any depth in the casing. Cup is reinforced with spring steel wires interlocked in a metal bushing and completely molded-in to seal and hold high pressures. The GW cup is available in more than 50 sizes to fit any casing or tubing in use today. Moderate in cost, for all its versatility, the GW is the hardest working hand on the rig!

More than a third of a century's experience serving the oil industry

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GUIBERSON
CORPORATION

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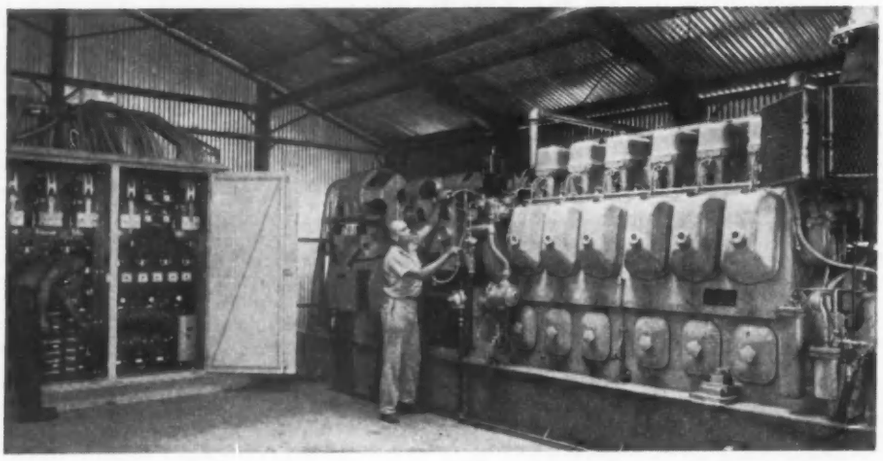
Sold By Leading Oil Field Supply Stores Everywhere

DRILLING



Rig Power Package

A new diesel-electric drilling rig power package has been introduced by ALCO Products, Inc. The first barge-mounted unit to be shown to oil industry experts, it is the first application of the standard power package announced last November.

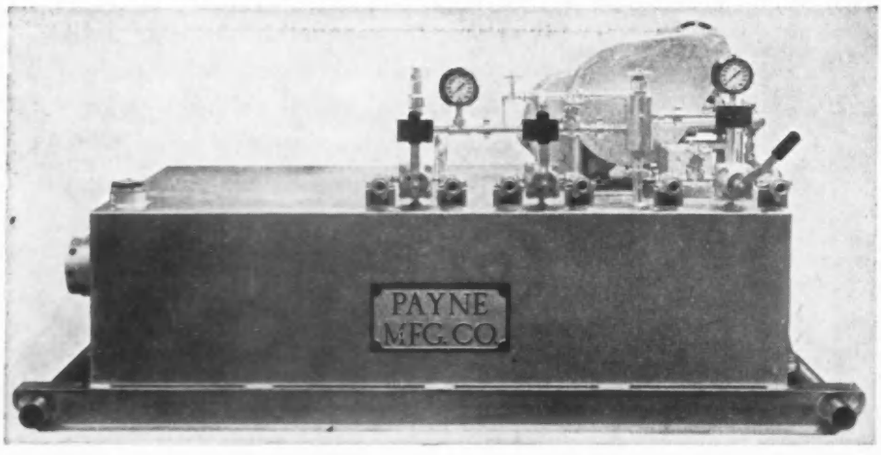
Primary power is furnished by two ALCO model 251 diesel engines, each skid mounted with two main generators and an auxiliary. The model 251 is a six cylinder, in-line version of the 9 by 10½ engine produced since 1946.

The complete power package also includes two drawworks motors, two mud-pump motors and control equipment. Drawworks and mud pumps can be operated singly or in combination and changing requirements can be met by simple adjustments from the driller's control stand.

The shunt-field motors—employed in the plant's electrical equipment do not require complicated controls to limit speed and torque. Controls for the entire plant consist of one compact equipment cabinet, plus a control stand and instrument panel.

ALCO's package plant is the first to provide a drilling rig's complete power requirements, including auxiliary power for lighting, shale shaker, water pumps, air compressor, cooking and other miscellaneous equipment.

For more data circle **No. E5** on Readers' Service Card, last page this issue.



Pump Accumulator Unit

A new type of pump accumulator unit designed for operation of all hydraulically-operated blowout preventers has been announced by Payne Manufacturing Company. The units are composed of a pump, a hydro-pneumatic accumulator, fluid reservoir and fluid control manifold for any number of blowout preventers.

Air, steam, electric and gasoline-powered pumps with several volumes and pressures are furnished with the units. The fluid pressure accumulator is manufactured in 40 and 80 gallon sizes, both with 2000 psi working pressure. When pressure drops to 1800 psi on the accumulator, the pump automatically returns the pressure to 2000 by means of a pressure switch which cuts the power to the pump at that pressure.

Custom-made units are available and various types of double-acting remote controls can be furnished in various combinations.

(This item supplements Payne Manufacturing Company data on Pages 4116-4119 of the Composite Catalog, 20th Edition.)

For more data circle **No. E6** on Readers' Service Card, last page this issue.

Rotary Exploration Drill

A one-man rotary exploration drill which weighs only 125 pounds, requires no water supply and can drill a 1¾-inch hole through 100 feet of the most difficult types of formation in the ruggedest terrain has been announced by American Percussion Tool Company.

The new APTCO rig, which can be carried in the trunk of a car or packed by two men into inaccessible country, can be set up in ten minutes. Because it operates on a new principle not requiring water, the drill can be used in broken and open fissure formation. Also, its operation prevents salting of the wall of the drill hole.

The drill has a swivel transmission that permits operation through a 360-degree range. A 9-horsepower McCulloch gasoline engine drives both the drill and lightweight Sutorbilt air pump. The tool's filtration unit includes a device that gives an instantly visible stratification picture of the formation as it is drilled. One-inch ID, 4130 drill pipe, which with couplings weighs less than one pound per foot, is specified for use with the drill. Specially designed drill bits for all types of formations are available.

For more data circle **No. E7** on Readers' Service Card, last page this issue.

Thread Lubricant

A new thread dope that contains No-Glo, a specially refined oil that will not fluoresce under ultra-violet light, is now available from Oil Base, Inc.

No-Glo thread lubricant is manufactured from a modified API formula and contains powdered copper, lead, zinc, graphite and molybdenum disulphide suspended in a heat resistant Bentone base. It is recommended especially for all joint sealing, for tool joints and drill collars.

This new thread lubricant is available in 3½ gallon pails, weighing 50 pounds net.

For more data circle **No. E8** on Readers' Service Card, last page this issue.

Diesel-Electric Unit

A new high horsepower, diesel-electric power unit for the oil industry that can be used in multiple to meet any deep well drilling requirement in both land and offshore operations has been demonstrated by Electro-Motive division of General Motors.

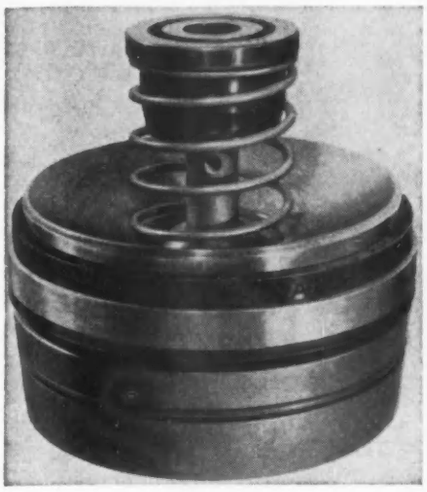
The unit brings to the drilling industry a flexible, lightweight power system easy to move and simplified in operation. Basic units consist of 8 or 12 cylinder General Motors 567C two-cycle diesel engines mounted on portable skids with two generators, generator control cabinet and engine cooling apparatus.

Direct current electricity from the generators is supplied by cable to the 625-horsepower motors which, singly or in pairs, supply power for the mud pumps, drawworks and rotary table. Protective relays and control circuits are basic in the control scheme.

For more data circle **No. E9** on Readers' Service Card, last page this issue.

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.

NEW EQUIPMENT . . .



Slush Pump Valve

Mission Manufacturing Company has added the Mud Monarch slush pump valve to their line of fluid end slush pump parts. The valve, specifically designed for high pressure jet drilling, brings a new principle of sealing to slush pump valve operation.

The valves are interchangeable because size and taper of the seat has been standardized for all pumps of the same size, using the same valve series. The valve body utilizes a center guide design and is a standard body that is interchangeable in all slush pumps of the same size using the same valve series. These adapters normally require no replacement as they are protected from wear by the rubber upper valve guide.

The upper valve guide, molded from a special oil and heat resisting compound, provides a bumping surface and shoulder for positive location of the valve spring. Balanced load valve springs which insure maximum valve efficiency are furnished with each valve and seat.

(This item supplements Mission Manufacturing Company data on Pages 3437-3524 of the Composite Catalog, 20th Edition.)

For more data circle **No. E10** on Readers' Service Card, last page this issue.

Pump Liners

A new liner, Tuffy Nuff, has been developed by the D & B division of Emsco Manufacturing Company to solve oil industry pumping problems.

These new liners are made of ductile iron, a metallurgical development that combines strength and ductility of steel with the low cost of iron. Ductile iron achieves its properties from a process which causes the graphite particles to become solid spheres rather than broad flakes which break up the continuity of the ordinary cast iron metal matrix.

(This item supplements Emsco Manufacturing Company, D & B Division, data on Page 1308 of the Composite Catalog, 20th Edition.)

For more data circle **No. E11** on Readers' Service Card, last page this issue.

Built especially to serve the great Southwestern petroleum area . . Lone Star's completely integrated steel mill is turning out API casing, tubing and line pipe in ever-increasing quantities. Joe Roughneck, symbolic figure of the oil industry, likes dealing with home folks at Lone Star . . likes the fact that he has a dependable source of API pipe right in his own neighborhood. Yes, whether Joe still works in the field or directs vast operations as president of his company . . he knows pipe . . and he knows about Lone Star's top quality and fast service.

Neighbor, wherever you are, specify Lone Star and we both get a good deal!

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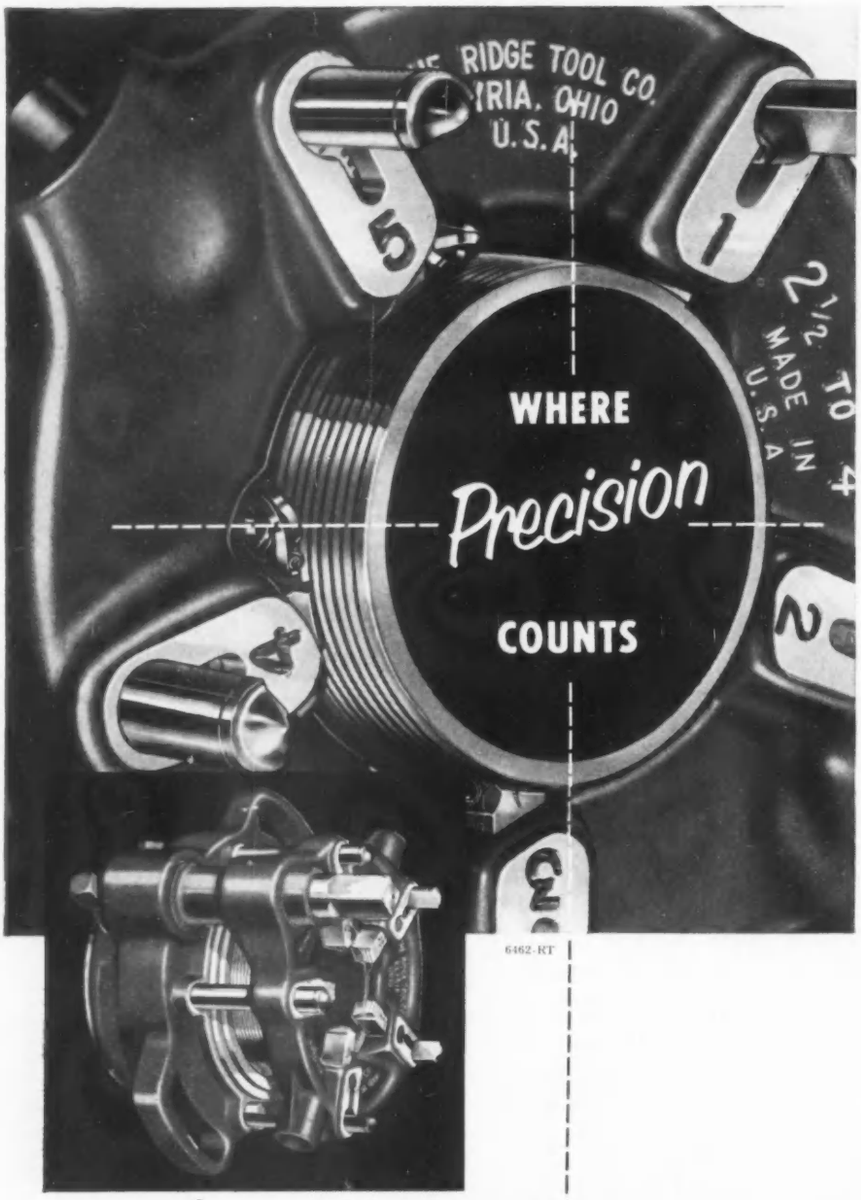

...use the RIDGID 4P

2½" TO 4" GEARED PIPE THREADER

Here's a work-saving precision tool that cuts accurate threads on 2½" to 4" pipe *every time.* It's easy to handle . . . easy to use . . . foolproof.

Operated manually or with power, the RIDGID 4P reduces time, sweat and scrap in any piping job. Balanced handles simplify carrying and starting on pipe. Mistake-proof workholder sets to size *before* tool is put on pipe . . . has only one screw to tighten . . . no bushings.

For precision and speed . . . you can't beat the RIDGID 4P!

See your local supplier . . . or write direct for catalog.

RIDGID
WORK-SAVER PIPE TOOLS

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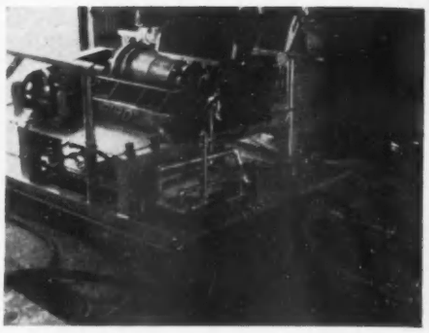
NEW EQUIPMENT . . .



Mud Centrifuge

Pioneer Centrifuging is unitizing Bird Centrifuges for rent and sale to the oil industry.

These centrifuges are designed to separate weighting material from light drill solids, thus allowing the operator to retain his weighting material and throw away the light solids which may cause viscosity troubles in drilling muds.

Pioneer is skid mounting the centrifuge to be placed over the mud tank, and is skid mounting on a separate skid the power unit and feed pumps. All units are being connected with hydraulic drives to the centrifuge and feed pumps.

For more data circle **No. E12** on Readers' Service Card, last page this issue.

Chain Compound

A new compound has been designed by Texas Iron Works, Rig division, with highest service factors possible in all components. Ease of servicing also has been designed into it for minimum downtime.

Three 250-horsepower engines, with pump drive, are mounted on a skid framing, with absolute parallelism between shafts. Air compressor mounting, with inboard drive to the air compressor, permits an over-all 127-inch width from front of radiator to outermost end of rotorseal guards. All oversize shaft assemblies may be removed in the field without having to move either the case or the engines.

The hand compressor mounted on the compound provides sufficient air for engaging the clutch of the Number 3 engine eliminating need for an extra starting compressor. Watertight-oiltight aluminum inspection hatches permit instant inspection of chains and oversize bearings inside the case at any time, without the use of tools.

(This item supplements Texas Iron Works data on Pages 4813-4848 of the Composite Catalog, 20th Edition.)

For more data circle **No. E13** on Readers' Service Card, last page this issue.

Use the Readers' Service blue post cards on the last page of this issue for more information on New Equipment, Catalogs and Literature.

PRODUCTION

Paraffin Heater

A new paraffin heater, developed jointly by N. W. Curson Associates of California and the General Electric Company, promises to increase production from low producing paraffin wells.

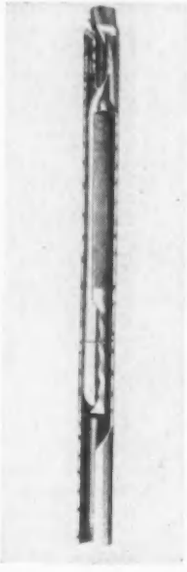
Although 20 percent of oil resources have been considered unobtainable behind the paraffin barrier, these sources now may be tapped. This new heating device, literally melting its way through the paraffin barrier, opens the way for consistent pumping of these wells.

The heater, 18 feet long, consists of six 80-inch Calrod heater units sealed in oil tight pipes. The pipes are enclosed in a rigid conduit which is lowered into the well.

For more data circle **No. E14** on Readers' Service Card, last page this issue.

Froth Anchor

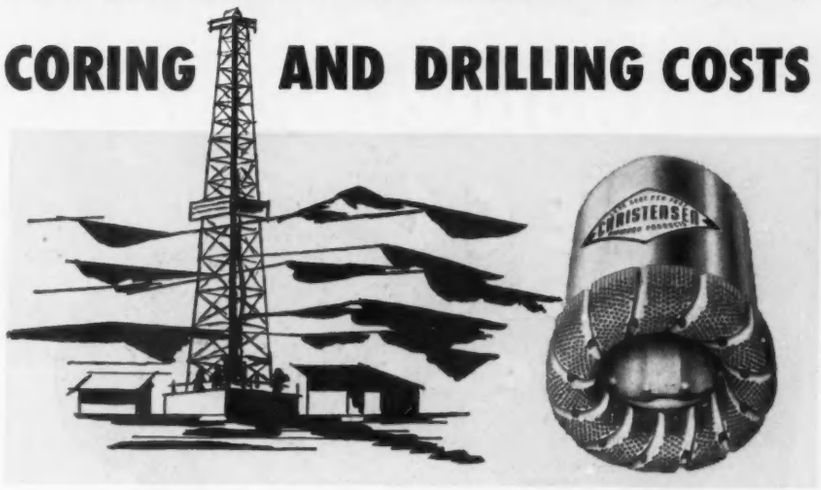
The Agate Anchor Sales Company of Los Angeles has introduced a new froth anchor designed to reduce high fluid levels by separation of oil and gas, correct rough pumping action and eliminate creation of tight emulsion in tubing and heading of production at the surface caused by gas. This will result in less wear, prolonged pump life and, in some installations, substantial increases in production.



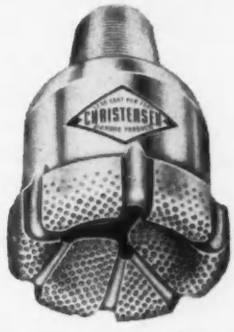
The anchor operates on a new principle. It is divided into two sections by a vertical baffle plate. An offset stinger extends into the pumpable fluid on the downstream side of the baffle, shielding the pump inlet from incoming oil. The bottom and lower section of the baffle permits the oil to accumulate, while the upper section is perforated to pass the froth into the gas space in the tool. As this is done, gas enters a free gas space, oil drops to be picked up by the stinger, and gas breaks out instantly. When sufficient gas has accumulated in the space provided, control valves at the top of the tool automatically open by means of precision-made stainless steel balls, and the gas is forced upward to escape through eight ports to the surface.

Control valve opens at 0.14 psi and assures a fluid level within the tool at all times. This is essential for rapid and efficient separation of gas from oil. The valve operation is not affected by the depth of submergence or casing pressure because anchor is open at the bottom and the pressures are equalized from above and below. The pressure differential between weight of the gas and gas space and weight of the corresponding height of fluid in the casing annulus actuates the valves. As gas accumulates in the tool it depresses the

DIAMONDS WILL REDUCE YOUR CORING AND DRILLING COSTS



No matter in what area your rig is operating . . . or in what formation . . . Christensen diamond bits will help you make hole for "Less Cost Per Foot." Check these four actual case histories . . . are your costs in line?



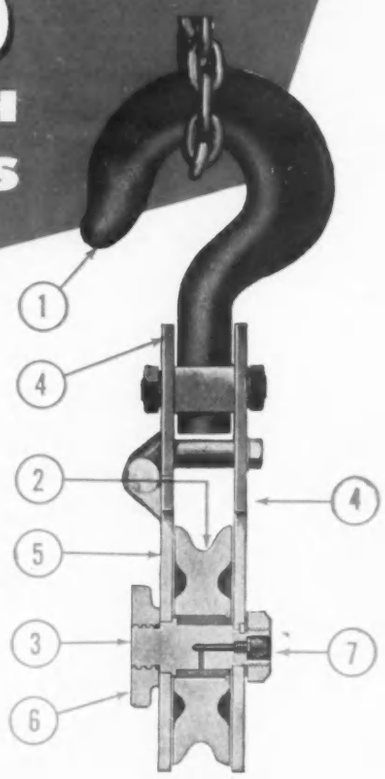
FORMATION / BIT SIZE	TOTAL FOOTAGE	PENETRATION RATE	TOTAL COST	BIT COST PER FOOT	DRILLING CONDITIONS BIT LOAD POUNDS	RPM	FL. VOL.
BETHANY FIELD, PANOLA COUNTY, TEXAS							
Pettete and Travis Peak 6⅛"x3½" Core Bit	1000 ft.	4 ft./hr.	$1600.00	**$1.60**	6,000-12,000	60	200 gpm
WILDCAT FIELD, LINCOLN COUNTY, LOUISIANA							
Travis Peak 8⅝"x5¼" Core Bit	725 ft.	3 ft./hr.	$2145.30	**$2.96**	8,000-16,000	50-60	275 gpm
QUALEY DOME FIELD, ALBANY COUNTY, WYOMING							
Red Beds 6-3/16" Drilling Bit	638 ft.	2 to 3 ft./hr.	$ 846.05	**$1.33**	5,000-12,000	70	230 gpm
WERTZ FIELD, CARBON COUNTY, WYOMING							
Tensleep 8⅞" Drilling Bit	408 ft.	1½ ft./hr.	$2187.11	**$5.34**	12,000	60	250 gpm

Why not call the Christensen office nearest your location for recommendations for the drilling or coring problems you are encountering.

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

THE Inside Story of WECO SNATCH BLOCKS



These design and construction features are the reasons for the outstanding performance, easy handling, long life and dependability you'll get from WECO Snatch Blocks in a multitude of services.

1. Drop-forged, heat-treated hook has 100,000 lb. capacity.
2. Forged steel sheave is precision machined and accurately gaged, assuring longer life for sheave and rope.
3. Extra heavy sheave pin has "Super Oilite" bearing for smooth-running strength.
4. ⅜" steel plate resists distortion.
5. Drop-Side (patented) is hinged for easier handling and stringing.
6. Wing nut, tightened or loosened with hammer, holds drop-side in place.
7. Zerk fitting for sheave pin lubrication.

25-ton working load capacity; available in 6", 8" or 10" sizes.

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it's wise to standardize with.. WECO

WECO ®

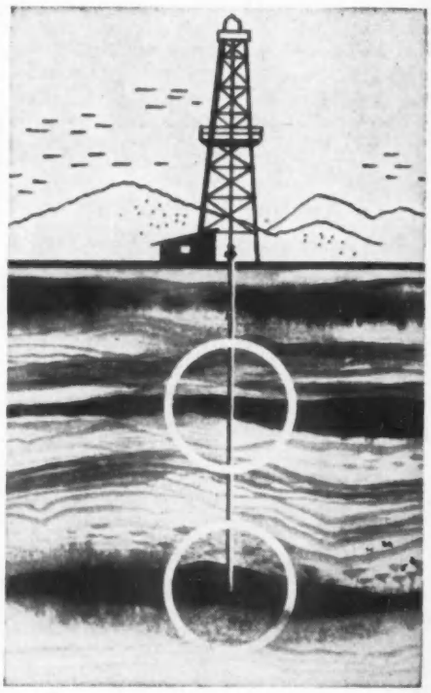
WELL EQUIPMENT MFG. CORP. • Division of Chiksan Company • HOUSTON 1, TEXAS

NEW EQUIPMENT . . .

oil, and the counteracting weight of the fluid forces the gas back up in the tool, opening the valves and expelling the gas. The valves close immediately as the pressure difference is reduced to their weight.

The anchor will work equally well with rod or fluid-powered pumps under any condition of submergence. This anchor is also efficient in any location relative to the incoming gas and will not obstruct a flowing well. It is simple to install. No packer or special handling is required.

For more data circle **No. E15** on Readers' Service Card, last page this issue.



Rod Pump

A new two-zone rod pump has been designed and developed by the Axelson Manufacturing Company. Incorporating a tubing cross-over principle, it allows dual pumping of high and low pressure zones in thief wells, thus eliminating necessity of drilling two wells. This two-zone pump is easily installed and serviced.

The complete working assembly of the pump can be run in and out of the well on sucker rods, facilitating quick repair and replacement of worn parts including balls and seats. Use of standard fittings assures availability of repair parts, permits flexibility in choice of parts and assures the right combination for every well condition.

The Axelson two-zone pump is designed on the traveling-standing valve principle. Only seating nipple and shoe remain in the well. Tubing must be pulled to service or replace this part. This principle allows the cross-over shoe to be designed with only a 4-inch OD, allowing these assemblies to be used in the smaller sizes of casing.

This item supplements Axelson Manufacturing Company data on Pages 297-340 of the Composite Catalog, 20th Edition.)

For more data circle **No. E16** on Readers' Service Card, last page this issue.

Plastic Pipe

Ed Conley Plastic Corporation is now producing high strength, lightweight plastic pipe for use in salt water disposal operations, tank batteries and sour crude gathering lines. The pipe is being made of glass fiber reinforced Plaskon polyester resins. Plaskon resins are products of Barrett division, Allied Chemical & Dye Corporation.

Conley pipe can be threaded with a hand pipe die. The fittings are available with standard molded reinforced threads or with deep sockets for resin bonding to unthreaded pipe.

Screwed fittings with standard threads have shear strengths of over 20,000 psi. Threading is long, precision molded and perfectly aligned to insure tight joints.

The socket-weld fittings, which come in standard ID sizes to fit standard plastic or metal pipe, are easily joined without need for special equipment.

The following pressure and weight data illustrate the strength of typical standard fittings: two-inch coupling—bursting pressure 1500 psi, working pressure (safety factor of 10) 150 psi, weight 6 ounces; three-inch elbow—bursting pressure 1800 psi, working pressure (safety factor of 10) 180 psi, weight 3¾ pounds.

For more data circle **No. E17** on Readers' Service Card, last page this issue.

PERFORATE TUBING IN THE WELL

KINLEY TUBING PERFORATOR

M. M. Kinley Company Licensees

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Tuboscope 2-3831, 4-1327
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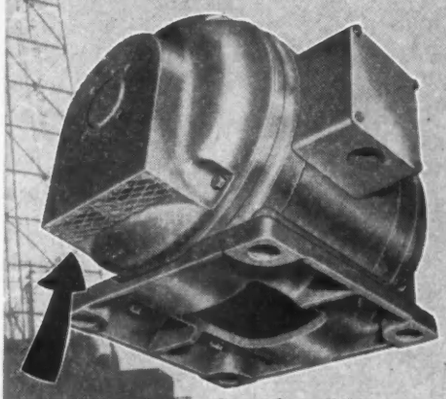
designed especially for *continuous* outdoor use . . .

FIELDMASTER
BALL BEARING
MOTORS

More and more FIELDMASTER Ball Bearing Motors are purchased for oil field use than ever before. Here's why: These **rugged** motors are **specially built** to meet the **tough** and **varied demands** of continuous outdoor use.

For example — heavy cast base assures alignment stability . . . heavy-duty, double-shielded, pre-lubricated bearings increase performance, reduce lubrication problems . . . high-grade silicon steel in the magnetic circuit reduces iron losses . . . wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems . . . high slip is available to take care of reciprocating load requirements encountered in pumping.

The FIELDMASTER has many other **outstanding advantages** that our distributor, the BETHLEHEM SUPPLY COMPANY, will be happy to show you. May we have them contact you . . . **without obligation?**



Screened Air Port Keeps Out Rodents!

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THE CHEMICAL PROCESS CO.
SERVICING OIL & GAS WELLS

Geofrac 5 and 15

Geofrac is The Chemical Process Company's special gel for fracturing and acidizing in a single operation.

It is exceptionally stable at high temperatures (240°), emulsion-preventing additives can be added to the acid phase effectively, it breaks out well, it has a good viscosity, good gel properties, and has a low fluid loss.

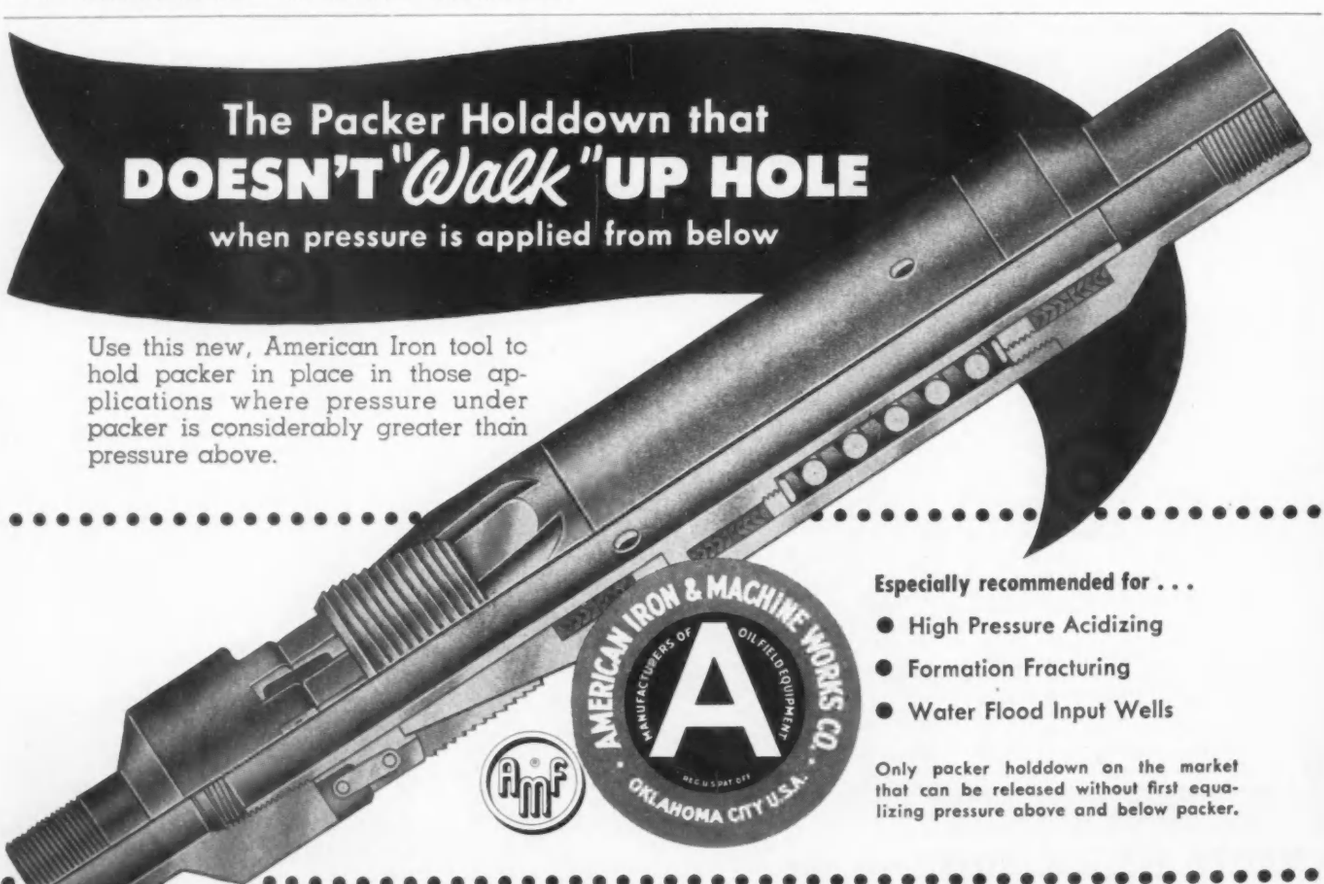
Geofrac has virtually unlimited sand-carrying abilities; we have run as much as 6 lbs./gal. with particularly effective results. Solutions are available with either 15 per cent hydrochloric acid (recommended for limestone and dolomite) or 5 per cent (for other formations). No gel-breakers or other solutions are necessary to clean up, no deposition is left in the well or the formation, and little or no shut-in time is necessary.

If you are not fully acquainted with Geofrac-5 and Geofrac-15, ask your nearest Chemical Process Company station for more details. Or write to us in Breckenridge, Texas; we'll be glad to send you illustrated literature and other data without obligation.

THE CHEMICAL PROCESS COMPANY

The Packer Holddown that
DOESN'T "Walk" UP HOLE
when pressure is applied from below

Use this new, American Iron tool to hold packer in place in those applications where pressure under packer is considerably greater than pressure above.



Especially recommended for . . .

- High Pressure Acidizing
- Formation Fracturing
- Water Flood Input Wells

Only packer holddown on the market that can be released without first equalizing pressure above and below packer.

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Specialty Tool Brochure

"ITCO-Equipped Lubricator for Permanent Completions" is the name of a new brochure featuring specialty items of the Bowen Company of Texas, Inc. Tools used on a lubricator and in the hole during permanent completion and well servicing operations—line wipers, wireline control head, wireline blowout preventer, electronic weight indicator, and wireline jarring tools—are described and illustrated in detail. Operating instructions, specifications and prices are included.

To get a copy circle **No. E18** on Readers' Service Card, last page this issue.

Side-Wall Coring

Life-size pictures of typical cores taken with the new side-wall coring tool are featured in a brochure recently published by Schlumberger Well Surveying Corporation. All oil producing areas of the U. S. are represented, indicating amount of recovery that can be anticipated in one or more possible producing horizons. Description, operation and advantages of the new side-wall coring device also are included.

To get a copy circle **No. E19** on Readers' Service Card, last page this issue.

Dehydrator Catalog

Black, Sivalls & Bryson, Inc., has issued a new catalog on the improved Model DDH dry desiccant dehydrators. New design features of the DDH include exclusive horizontal sorbers for easier installation and increased desiccant efficiency. The unit is completely automatic requiring no outside power sources for operation. A salt bath heater furnishes high regeneration gas temperatures at maximum safety, and automatic cycling of the sorbers is provided with three-way switching valves. The catalog is illustrated with photographs and flow diagrams.

To get a copy circle **No. E20** on Readers' Service Card, last page this issue.

Rolling Bearings

While featuring the new SCM line of ball bearing pillow blocks and flange cartridge mounts, a new bulletin recently published by Dodge Manufacturing Corporation contains technical information and list prices on the complete line of Dodge SCM ball and Dodge-Timken roller bearings.

Tabular data include engineering drawings, dimensions, shaft sizes, weights, radial load ratings and list prices. Illustrations, including cutaway views showing inner construction, are included as well as installation photos showing typical applications of products.

The bulletin presents for the first time full technical facts relating to the new line of SCM ball bearing pillow blocks and flange cartridge mounts designed by Dodge for medium duty service. Complete technical data also is presented in the bulletin covering five major types of Dodge-Timken bearings including the new All-Steel. In addition to pillow blocks and flange cartridge types the bulletin includes illustrations and data relating to plain units, flange and hanger bearings and take-ups.

To get a copy circle **No. E21** on Readers' Service Card, last page this issue.

Fire-Fighting Equipment

Information about Foamite Airfoam fire extinguishing equipment for combatting various types of flammable liquid fires is contained in a new booklet published by the American LaFrance Corporation, engineers and manufacturers of fire-fighting equipment. The booklet contains engineering data on Foamite Airfoam fixed fire protection systems, portable equipment and semi-portable equipment. Semi-portable systems are for installation where tankage is widely separated, water is available and roads for mobile equipment are maintained. The booklet also includes information on American LaFrance Foamite Airfoam trucks.

To get a copy circle **No. E22** on Readers' Service Card, last page this issue.

Oil-Hydraulic Equipment

A new catalog describing the complete line of oil-hydraulic pumps, controls and accessories for general industrial applications has been published by Vickers Incorporated. The catalog includes engineering, design and application information relating to pumps, pressure controls, volume controls, directional controls, control assemblies, hydraulic motors, transmissions, cylinders and hydraulic accessories. Each category includes descriptions of the various units which make up the group.

The booklet describes each unit in detail, shows photographs, cutaway views and typical circuit drawings where required. Operation is explained, applications recommended and all pertinent data relating to selection, purchase and application of hydraulic equipment is listed. Tables showing modern designations, ratings and capacities as well as typical performance curves also are included.

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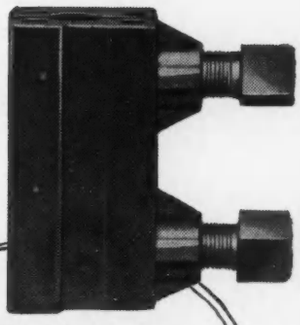
Power Unit Manual

"On the Spot . . . Air Power Package" is the title of a new manual recently released by Ingersoll Rand which emphasizes the self-contained Spot-Air portable compressor. It also presents the many tools it will operate. Illustrations are used to point out the added advantages of the lightweight compressor on jobs where bigger compressors are not needed.

To get a copy circle **No. E24** on Readers' Service Card, last page this issue.



RATIGAN POSITIVE ACTION

"SURE GRIPS"

PROTECTS YOUR INVESTMENT

Extremely popular because of their positive gripping and holding power, Ratigan #50 and #204 Grips assure greater safety on the pumping well . . . once properly installed, you can almost forget them.

These Ratigan Grips have a holding capacity of approximately 53,000 lbs., yet they are lightweight for easy handling. Both the #204 and #50 are made in sizes for 1⅛", 1¼" and 1½" polished rods. The #204 is especially suited to pumping units which require a short gripping device.

#50

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